

186 Center Street Suite 290 Clinton, NJ 08809 (908) 735-9315 (908) 735-2132 FAX



February 14, 2001

Mr. Nigel Robinson
United States Environmental Protection Agency
Region II - Emergency & Remedial Response Division
290 Broadway - 19th Floor
New York, NY 10007-1866

RE: Chemsol, Inc. Superfund Site

Dear Mr. Robinson:

Enclosed please find five (5) copies of the Response to Comments to EPA's January 18, 2001 comment letter, and a redline/strikeout version of the revised Groundwater Remedial Design Work Plan (RDWP).

Following EPA's review and approval of the attached revised RDWP, a final version will be issued as we have discussed.

Thank you for your attention to this matter.

Very truly yours,

de maximis, inc.

William . Lee

cc: Paul Harvey, NJDEP

William Hyatt, Esq., Pitney, Hardin, Kipp & Szuch

Chemsol Technical Committee

3056D/response to Comments 01 (03)/slr



RESPONSE TO USEPA, JANUARY 19, 2001 TECHNICAL REVIEW COMMENTS GROUNDWATER REMEDIAL WORK ELEMENT JUNE 2000, REMEDIAL DESIGN WORK PLAN CHEMSOL, INC. SITE

Note: Original comments shown in standard font. Responses shown in Italics. Wherever the USEPA had indicated that a comment was adequately addressed, no response is given.

Comment:

This technical review has been performed by U.S. Environmental Protection Agency (EPA) and the New Jersey Department of Environmental Protection in order to determine whether:

- the remedial design activities proposed by the Chemsol Superfund Environmental Remediation Trust (Chemsol ERT) comply with the requirements of the September 1998 Record of Decision (ROD), the August 1999 Consent Decree and Statement of Work (SOW);
- 2) the comments on the August 1999 Remedial Design Work Plan (RDWP) dated December 1999 provided by EPA, the New Jersey Department of Environmental Protection (NJDEP) and its contractors have been addressed by the Chemsol ERT in an adequate and satisfactory manner, and,
- 3) the additional comments on the RDWP provided by EPA in letters dated April 24, 2000 and May 1, 2000, have been addressed by the Chemsol ERT in an adequate and satisfactory manner.

The comment numbers listed below correspond directly to EPA's 1999 comments and evaluate how the comment was (or was not) addressed.

Response:

To darify, particularly with respect to the USEPA's comments of December 1999, as stated in April 28, 2000 and May 15, 2000 letters from de maximis, inc. to USEPA, the RDWP was to be revised in accordance with a) specific comments G-1, W-21, W-22, A-2, A-3, A-12, A-16, A-19, B-3, B-4, B-17, B-19, and B-21; b) the readily addressed comments agreed to in our conference call of January 7, 2000; c) the agreements represented in the de maximis, inc. letters of February 1, 2000, February 17, 2000, A pril 28, 2000, and May 15, 2000, d) the March 2000 progress report, and e) USEPA's letters of April 24, 2000 and May 1, 2000. It was not the intent to address all of the December 1999 comments as there had been disagreement on a number of the issues that were reconciled as denoted in the letters referenced above.

General Comments:

Comment:

G-1 This document mentions all of the Pre-Remedial Design Activities and Remedial Design Activities listed in Sections III and IV of the EPA SOW attached to the Consent Decree.

However, this revised work plan does not always describe how these activities will be performed or implemented by the Chemsol ERT, as requested in EPA's December 1999 comments. As stated in EPA's original comments, this work plan must attempt to address all anticipated activities that will be performed and describe them in sufficient detail. All tasks and subtasks should be described in a site-specific manner. Contingency provisions should also be described for activities that are dependent on results of future testing or subject to off-site or external influences. Further, since Chemsol is a Superfund site, the procedures and methods used to perform all of the work must meet the most stringent and current EPA Region II and NJDEP requirements.

Response:

This is a general comment that is addressed by individual comments that follow

Comment:

G-2 As stated in EPA's December 1999 comments, the RDWP should include relevant text, tables and figures from documents that have been previously prepared for this site and submitted to EPA; it is not sufficient to merely cite the reference. Examples of information that should be included in the work plan are: a summary of the analytical results from the November/December 1998 site-wide groundwater sampling; a summary of well construction details of all existing site wells; plan and cross-section views of current groundwater flow contours and range of water levels; and relevant portions of the numerical groundwater flow model and groundwater extraction scenarios. This allows the reader to properly evaluate the existing data gaps and the additional work that has been proposed to supplement the existing database and design the chosen remedy. This information should be presented as an appendix to the document.

The Pre-Design Verification Study (PDVS) is not adequately detailed in the document and is not based on the November/December 1998 site-wide groundwater sampling. Also, the potentiometric contours based on 1994 pre-pumping data should not be used. Instead, more current data from an extended groundwater treatment plant shut-down period, such as the July 1999 static (non-pumping) conditions, should be used. Additional information including the following items must be added to the document:

- Justification for the proposed pumping rates and locations of extraction wells and monitoring wells, to include results of the numerical modeling (updated with more recent sampling and potentiometric data).
- Specific locations of monitoring wells that will be monitored for draw-down and their location within the current groundwater contaminant plume (based on recent data).
- The proposed water level measurement method to be used during the pumping tests. Pressure transducers and a data logger must be used in more select wells to provide accurate and continuous water level data (the proposed number of monitoring wells

and the daily water level monitoring is inadequate).

The document does not address SOW Section III.A. Although the round of groundwater samples required in this item has been collected and presented in a document entitled Site Wide Groundwater Sampling Data, Fall 1998, this document simply presents the results in a tabular format and does not evaluate the current extent of groundwater contamination as required by this item of the SOW. Figures depicting the extent of groundwater contamination in each hydrostratigraphic unit based on results from the November/December 1998 sampling should be included in the revised document to assist in determining the required area of capture.

Response:

As noted in the February 17, 2000 letter from de maximis, inc. to the USEPA, the Chemsol Site PRP Group had expressed concern that, as reflected in this comment, the USEPA was requesting a level of information normally associated with a remedial investigation or remedial design report, but not a work plan. In addition, the PRP Group believes it entirely appropriate to reference previous submittals rather than repeating the information. In response, the USEPA indicated that fairly minor inclusions would satisfy this comment.

Nonetheless, based on the discussions at the January 23, 2001 meeting, the following was agreed to in response to this comment:

- Total volatile organics concentrations from the 1998 site-wide groundwater sampling will be plotted on site maps, according to hydrostratigraphic unit, and appended to the RDWP.
- Table 1 from the report entitled "Site-Wide Groundwater Sampling Data, Fall 1998," Chemsol, Inc. Site", February 1999, which contains well completion information (e.g., casing diameter, screen length, etc.) will be modified and appended to the RDWP.
- Eight wells will be equipped with pressure transducers for both the antecedent water levels and during the PDVS.
 Data loggers will be installed in wells MW-201UP, MW-201P, MW-201L, C-6, DMW-9, MW-202L,
 C-7, and DMW-10. These wells represent those dosest to the newly proposed pumping wells and include two dusters of three wells (wells in the Upper Permeable, Principal and Deep Bedrock), and one duster of two wells (Upper Permeable and Principal) located along the back property line.
- Potentiometric maps from water levels measured during the 1999 plant shutdown (static) will be appended to the RDWP (note: these water levels are essentially the same as the 1994 data).
- No additional information on the groundwater modeling will be necessary.

Comment:

G-3 This comment was properly addressed by the Chemsol ERT (except for minor problems identified below) and suitable SW-846 methods were chosen for analysis. As can be seen from Table B-1 in Appendix B of the Quality Assurance Project Plan (QAPP), there are several instances where the method detection limit is numerically higher than the Maximum

Contamination Limit (MCL) for a given compound. This may become significant for those compounds that were previously detected at the Chemsol site at concentrations slightly greater than the MCL in the groundwater (e.g., benzo(a)pyrene). In this table, MCLs for some compounds are not included (e.g., bis(2-Ethylhexyl)phthalate). Please address this inconsistency.

Response:

An MDL higher than an MCL occurs only for the semi-volatile organic constituents of benzo(a) pyrene), 1,2-diphenylhydrazine, hexadolorobenzene, hexadolorobutadiene, and pentadolorophenol and the metals benyllium and thallium, all of which are much less mobile in the environment than the volatile organic constituents that have been identified as constituents of concern at the site. In addition, of the semi-volatile constituents, only benzo(a) pyrene was detected and infrequently at very low levels. Benyllium was not detected above the MCL during the RI. Thallium detections were also at low levels and only with corresponding detections in the method blanks. As a result, none of the constituents with MDLs higher than an MCL are considered to be constituents of concern at the site. This will be darified in the QAPP, Section 3.4.

MCLs missing from Table B-1, Appendix B, will be added.

Comment:

G-4 As stated in the December 1999 EPA comments, this revised work plan does not adequately address the requirements of SOW Sections V.D. (Page 13) relating to compliance with ARARs. The RDWP must be revised to comply with this SOW requirement.

Response:

During the January 23, 2001 meeting, the USEPA clarified the intent of this comment. The comment is intended to ask whether a variet of ARARs will be sought for the purpose of a surface water discharge, as had been identified as a possibility during previous evaluation of a surface water discharge option.

In response to this darification of the intent of the comment, QAPP Section 3.4 will be revised to include a discussion of surface water discharge and the absence of any intent to seek a waiver based on currently expected discharge limits. Since the surface water discharge option is still being evaluated, if changes occur that would affect this option and ARARs, the USEPA will be notified and adjustments made accordingly.

Comment:

G-5 The revised RDWP must explicitly state that if the Chemsol ERT is unable to establish complete containment of contaminated groundwater within the boundaries of the site, based on the observations in the monitoring well network, additional extraction and monitoring wells will be added to the proposed system to achieve and verify containment in all contaminated hydrostratigraphic units, as required by the ROD and Consent Decree.

The decision about the number of wells needed for remediation will be made after further information is collected regarding the radius of influence of the proposed extraction wells and their capture zones within the respective hydrostratigraphic units are verified.

Response:

Such statements are made in the RDWP as follows:

- Section 2.2, last paragraph, states: Based on data collected during the PDVS, the groundwater extraction system will be adjusted as applicable to achieve the objective of containment of contaminated groundwater on the property owned by the Owner Settling Defendant (as sated in the objectives of the SOW).
- Section 2.2.2, last paragraph states: "In this manner, the design of the groundwater extraction and containment system will be based upon the observed responses to pumping and the system design will modified accordingly, if needed, including additional wells that may be located either on or off the site property."
- Section 3.5, next to last paragraph, states: Therefore, in the event that containment is not adviewed with the
 initial well layout and the construction configuration (e.g., open interval), presented as the starting point for the
 PDVSA, additional efforts will be undertaken. These additional efforts may include increased pumping rates or
 new well locations."

Based on the foregoing, it was agreed at the January 23 meeting that no further edits to the RDWP would be required.

Specific Comments:

Work Plan (WP)

WP Section 1 - Introduction

Comments:

- W-1 Page 1-1, Bullets (List of activities). This comment was addressed properly.
- W-2 This comment was addressed in a satisfactory manner.

WP Section 2 - Technical Approach

Comment:

- W-3 The only pre-design remedial activities addressed in this section are SOW activities III.E, the PDVS (in Section 2.2, Page 2-4), III.F and III.G (in the Soil Delineation Program, WP Section 2.1, Page 2-1). The technical approach for items listed below was not provided in this section as requested in EPA's 1999 comments.
 - SOW item III.A (sampling of existing wells). Although the sampling of existing wells was performed in December 1998 and a report tabulating the results was submitted in February 1999, no interpretation of this data was provided as requested

previously. See comment G-2 above. EPA firmly believes that this data evaluation is necessary in planning the proposed PDVS.

Response:

As stated in the response to Comment G-2, the PRP Group believes that analysis of the data is appropriately made in the PDI report, not in the work plan. However, to more the project forward, total volatile organic concentrations, measured during the December 1998 groundwater sampling, will be plotted on site maps, by hydrostratigraphic unit and appended to the RDWP.

Comment:

• It appears that the new wells and sampling of the new wells, discussed in WP Section 3.9 (Page 3-17) are intended to address the groundwater part of this item. As stated previously in EPA's 1999 comments, the proposed locations and numbers of monitoring wells do not adequately address off-site migration of contaminated groundwater; however, the installation of off-site groundwater wells has been deferred to the OU3 RI/FS, as agreed. Also, the rationale should have been included in Section 2.

Response:

During the meeting on January 23, de maximis, inc., and Brown and Caldwell presented an alternative approach to the siting of the proposed extraction wells, as compared to the locations shown in the June 2000 RDWP. The extraction wells under this alternative proposal would be repositioned to the north, closer to the downgradient property boundary. The intent of this repositioning is to provide greater flexibility to the capture limit on the downgradient boundary in light of the pending OU-3, off-site, investigation. That is, if the off-site work were to show the need to expand the zone of capture farther to the north, this repositioning would add such flexibility.

To assist in USE PA's evaluation of this alternative approach, maps were provided showing the revised well locations and total volatile organic concentrations (from the December 1998 groundwater monitoring) in the upper bedrock, upper permeable aquifer, upper principal aquifer, lower principal aquifer, and deep bedrock hydrostratigraphic units.

The USEPA reviewed the information provided and this topic was discussed in a conference call among representatives of the USEPA, de maximis, inc. and Brown and Caldwell on February 14, 2001. During this call, USEPA indicated that it prefers this new approach but would like to see a hybrid that includes extraction wells focusing on contaminant mass removal (USEPA's interpretation of the extraction wells to the north is that they focus on containment not mass removal). Brown and Caldwell and de maximis, inc. disagree and believe that these northerly positioned wells will also effect comparable mass removal given that the contaminant mass now resides in the bedrock matrix and localized pumping will not have a material impact on site deanup (see Section 2.2.2 of the revised RDWP for more discussion of the basis for the well locations). The participants in the conference call agreed to evaluate this issue further and continue the discussion to arrive at a mutually agreeable resolution.

A sentence indicating that additional information related to water quality and zone of capture would likely be available from wells installed as part of the OU-3 investigation was added to Section 2.2.2. In addition, it was agreed at the January 23 meeting that the revisions to the RDWP to describe this alternative approach to siting of the extraction wells would address this comment.

Comment:

• SOW item III.D (evaluation of existing groundwater treatment plant to determine its capacity). This item is mentioned later in Section 3.4 of the WP (Page 3-6) and was partially addressed. More details should have been provided. The rationale should have been included in Section 2.

Response:

The RDWP will be revised, in Section 2.0, to include a bulleted list of examples of how the PDVS and treatment plant information will be used to assess the existing treatment plant. For example, if hydraulic capacity of pumps were an issue, then the example might indicate that pumps could be dranged out. If treatment capacity in the carbon filters were an issue, another example might be use of the carbon units in parallel rather than series, given the excess capacity in these units.

It was agreed that no recision is necessary to Section 3.4 of the RDWP.

Comment:

• SOW Item III.H (Performance of the Stage IB cultural resources survey). This item is mentioned later in Section 3.11 of the WP (Page 3-19) and was adequately addressed. The rationale should have been included in Section 2.

Response:

At the time that the June 2000 RDWP was prepared, a copy of the Phase IA Cultural Resources Survey was not available. Since that time, the USEPA has provided a copy. Based on the information contained in the Phase IA report, a section will be added to the RDWP in Section 2.0 to discuss the approach to the Phase IB study.

Comment:

W-4 Similarly, the only remedial design activity addressed in this technical approach section is SOW activity IV.D, the Long-Term Water Level Monitoring (in WP Section 2.3, Page 2-11). The Chemsol ERT has indicated that long-term surface water monitoring as required by SOW activity IV.D will be decided after details for removal of soils from Lot 1B are decided. Long-term monitoring of Stream 1A will depend on whether the surface water discharge of treated groundwater is the selected option.

SOW items IV.A, IV.B and IV.C are briefly mentioned in various portions of WP Sections 4.1 and 4.2. The technical approach for these design activities should have been included in WP Section 2 as requested by EPA.

Further, it should be noted by the Chemsol ERT that EPA has agreed to defer the requirements for annual surface water and sediment sampling in Streams 1A, 1B, and the Northern Ditch (SOW activity IV.E) pending details concerning the soil excavations and surface water discharge of treated groundwater. The requirement has not been eliminated P:\^J\20541\RDWP\usepa groundwater comments response chemsol rdwp.doc

and must be addressed in detail in the Final Design Report.

Response:

As darified at the January 23 meeting, SOW items IV.A. and IV.B. are soils related and have been previously dealt with through the approval of the soils portion of the RDWP.

SOW item IV.C. addresses the design of the groundwater extraction and treatment system which is discussed in Sections 4.1 and 4.2. It was agreed that no further revision to the RDWP would be necessary in this regard.

Section 3.2 of the RDWP states: "The need for additional surface water and sediment monitoring will be evaluated during the remedial design and will be based upon the conditions that will exist after implementation of the remedy. For example, if the selected remedy calls for the removal of soil/sediment from Stream 1B or relocation of the stream channel around the impacted area, the proposed monitoring program would be different than a scenario in which the area remained untouched." Based on this language it was agreed that no revisions to the RDWP would be necessary in response to this comment.

Comment:

W-5 <u>Page 2-4, Section 2.2, Pre-Design Verification Study.</u> This comment was partially addressed. See comments G-2 and G-5 above.

Response:

Addressed in Comments G-2 and G-5.

Comment:

W-6 Page 2-5, Section 2.2.1, Conceptual Hydrostratigraphic Model. The second layer is referred to as the Upper Bedrock Aquitard in Figure 2-1. The change requested by EPA was made in the text but not in the figure.

Response:

This was an oversight and will be corrected in the revised RDWP.

Comment:

It is stated that the maximum thickness of the Upper Permeable Aquifer may be approximately 40 feet. The data supporting this statement should be presented. Rock cores gathered during the remedial investigation showed this layer to be 15 to 20 feet thick. Please refer to EPA's Responsiveness Summary (Page 15).

Response:

During the January 23 meeting, Brown and Caldwell darified that there are two approaches to the definition of thickness for the Upper Permeable A quifer. The first is by direct observation of the geologic characteristics, which the P:\^J\20541\RDWP\usepa groundwater comments response chemsol rdwp.doc

USE PA applied. The second is by hydrostratigraphic duracterization, which Brown and Caldwell applied. These two approaches yield slightly different estimated thicknesses of the unit. Both will be described in the revised RDWP.

Comment:

EPA had requested an explanation why the Upper Gray Shale (Aquitard) was identified as a separate hydrostratigraphic unit, but the Deep Gray Shale was not considered a separate unit. This explanation was not provided.

Response:

Section 2.2.1, bulleted item entitled Deep Bedrock Unit, explains that the deep gray shale provides only some laydraulic separation between the Principal aquifer and the deep bedrock unit. However, the language may not have been as clear as intended and, therefore, this explanation will be further clarified in the revised RDWP.

Comment:

The thickness range for each of the hydrostratigraphic units should have been provided in the revised RDWP as requested by EPA.

Response:

Table 3-2 of the RDWP provides elevation data for the various hydrostratigraphic units in relation to the proposed extraction wells. This table will be revised to include the thickness of each hydrostratigraphic unit.

Comment:

EPA had requested that the overburden zone and the wells screened in this unit should be incorporated into Figure 2-1. This was not done.

Response:

At the scale of Figure 2-1, the overburden and overburden wells would not be discernable. It was agreed, therefore, that Figure 2-1 is adequate as is.

Comment

W-7 Figures 2-2 through 2-5 (Plan-view potentiometric contour maps). Please note that the potentiometric gradients at the site in the various hydrostratigraphic units are essentially flat and, therefore, easily influenced by potential off-site pumping. Contaminant migration across site boundaries can potentially occur at other locations besides the northern site boundary with the apartment complex.

Response:

As agreed at the January 23 meeting, no response is required for this item. A meeting with USEPA was held at the site on December 18, 2000 to discuss hydraulic gradients at the site and the implications to the design of the groundwater extraction system. The USEPA expressed concern that the flat gradients, as noted in this comment, P:\^J\20541\RDWP\usepa groundwater comments response chemsol rdwp.doc

could be easily influenced by off-site pumping. However, responding to such concerns at this time would be pume conjecture, since the rate of pumping, screened interval, location of such pumping would be unknown. As a result, it was agreed that during the design, contingency measures such as additional force main piping to accommodate additional pumping wells, would be considered.

Comment:

EPA had requested an explanation of why wells like TW-6, TW-8 and TW-14 which are screened across the Upper Gray Shale (Aquitard) were included in the potentiometric contour map for the Upper Principal Aquifer (Figure 2-4). This explanation was not provided.

Response:

The explanation was provided on Figure 2-4 under the Note. This explanation will be expanded to note that the upper principal aquifer will have the greatest influence on water level and thus these wells, screened across both the Upper Gray Shale and the Upper Principal A quifer, were considered representative of the Upper Principal A quifer.

Comment:

Vertical cross-section view potentiometric contour maps must also be provided in the revised RDWP as previously requested by EPA.

Response:

Vertical cross section potentiometric contour maps are prepared with the monthly water level reports provided to the USEPA. These potentiometric contour maps for the 1999 shutdown period will be added as figures in the RDWP for reference.

Comment:

W-8 Page 2-8, Section 2.2.2, Groundwater extraction wells. Even though the Chemsol ERT has stated that the proposed groundwater extraction scenario is a starting point, EPA continues to believe that the number of extraction wells and pumping rates proposed in this section may not be sufficient to contain off-site migration of contaminated groundwater across the entire site at all depths. As stated previously, the proposed extraction scheme in this revised RDWP (which is based on 1994 data and has not been updated with more recent data) appears incapable of extracting water from all the contaminated water-bearing units identified during the remedial investigation. The extraction system for the site must be able to remove contaminated water from the Upper Bedrock Unit, which ranges in thickness from approximately less than 30 feet to over 100 feet. See comments G-2 and W-5 above.

Response:

As discussed during the January 23 meeting, the RDWP is clear (as described in the response to comment G-5) that the groundwater extraction system will be modified, as appropriate, to attain capture on the site property and thus no additional response is required for this comment.

Comments:

- W-9 <u>Page 2-10, Section 2.3, Evaluation of Wells TW-4 and TW-5.</u> This comment was addressed adequately.
- WP Section 3 Pre-Design Investigation (PDI)Scope
- W-10 Page 3-1, Section 3.0, First Paragraph, Top of page. As suggested by EPA, use of SW-846 methods was accepted by the Chemsol ERT for the PDI and design-stage analyses.
- W-11 Page 3-5, Section 3.3.1, Locate Well MW-104. The Chemsol ERT has stated that they do not recommend replacement of well MW-104 if the well cannot be found or appears to be in a condition that is unsuitable for sampling. This recommendation appears to be acceptable for this operable unit. A new well may need to be installed as part of the off-site RI/FS.
- W-12 <u>Page 3-5, Section 3.3.2, Groundwater Quality Sampling.</u> This comment was addressed as requested.

Comment:

W-13 Page 3-6, Section 3.3.3, Long-Term Water Level Monitoring. The rationale for selecting only five relatively shallow wells on the southern side of the site was not explained. Such monitoring should be performed, at a minimum, along the entire site perimeter and at a few select wells within the interior of the site in all depth intervals, to determine potential changes due to off-site influences.

The SOW (Section V.A.1.h) indicates that "a plan for continuous water-level monitoring under on-site static conditions to evaluate potential effects of off-site pumping on the groundwater system at the site" should be submitted and does not specify that influences only to the south of the site be determined. This comment must be addressed in the revised RDWP.

Response:

It was darified that the long-term monitoring referenced in this section refers to the ongoing monitoring that has been performed to confirm groundwater flow direction from south to north (following cessation of pumping to the south). The RDWP will be darified in this regard to distinguish long-term monitoring for the purpose of system performance evaluation from the groundwater flow direction issue at the site's southern boundary.

Comment:

W-14 <u>Page 3-6, Section 3.4, Groundwater Treatment Plant Evaluation.</u> The comment was partially addressed. More details should have been provided, such as the future capacity of the treatment plant.

Response:

This comment will be addressed as described in the response to comment W-3.

Comments:

- W-15 As agreed, off-site wells would be installed as part of the off-site RI/FS and integrated into the Remedial Design/Remedial Action as necessary.
- W-16 <u>Page 3-9, Section 3.5.1, Extraction Wells.</u> This comment was addressed in a satisfactory manner.

Comment:

W-17 Page 3-10, Section 3.5.2, Monitoring Wells. The revised RDWP indicates that the screened portion of each monitoring well will be placed at the 10-foot interval having the greatest permeability as measured by the packer tests. As stated previously, this approach may not target the zones with the highest levels of contamination. The primary purpose of a monitoring well for this operable unit is to track groundwater contamination in all depth zones. EPA's preferred approach would be to sample (using packers to isolate) fracture zones identified by the downhole geophysics. Additional wells may be necessary based on the number of contaminated fracture zones identified in each unit.

Response:

As discussed at the January 23 meeting, the primary objective of the groundwater remedy is groundwater containment on the site property. As such, the monitoring wells are targeted for zones of greatest permeability since this will provide the best overall indication of the hydraulic influence of the groundwater extraction system. In addition, the proposed monitoring well installations are not designed to further characterize the distribution of constituents in groundwater at the site, since the previous investigation of the site has provided such characterization sufficient for the design of the on-site groundwater remedy. Based on these discussions, it was agreed at the meeting that no modification of the RDWP would be necessary in response to this comment.

Comment:

W-18 Page 3-11, Section 3.5.2, Deep Bedrock Unit. EPA's comment was not adequately addressed. The proposed approach potentially allows for cross-contamination between the principal aquifer and the deep bedrock unit (eg, contamination in well DMW-9 could move down into proposed well MW-202L, since there is no separate casing at the deep gray shale). Also, the text in this section refers to packer testing at ten-foot intervals. Section 5.2.5 of the SAMP (Appendix A) refers to five-foot intervals for packer testing. Please clarify the correct interval that will be used.

Response:

At the January 23 meeting, we discussed the overall rationale for not using multiple casings for the deep wells (i.e., deep wells with large diameter borehole, limited potential for any significant impact since all of the hydrostratigraphic P:\^J\20541\RDWP\usepa groundwater comments response_chemsol rdwp.doc

units are corrently impacted, and an existing well currently screened across the deep gray shale). To finther darify, as presented in an e-mail to USEPA dated January 30, 2001, we would do the following to limit the potential for cross contamination:

- The plan for the deep wells is to drill to approximately 30 feet below the deep gray shale and complete a well at the ten foot interval below the deep gray shale which had the highest permeability based upon packer testing. If near the end of the day, the drilling will stop above the deep gray shale and will be completed the following day. Similarly, upon reaching the total depth the drilling rods will be pulled and packer testing will proceed based upon the time of day. If within several hours of the end of the day, the double packer assembly will be installed to total depth and the packers will be inflated just above the deep gray shale and left in this position over night. Packer testing will resume in the morning. If there are sufficient work hours left in the day, packer testing will begin from the top down in ten foot intervals so that by the end of the day the packers are near the bottom and can be left inflated overnight. The above procedures will be implemented to limit the amount of time that the borehole is open below the deep gray shale.
- Once the interval in which the well is to be installed has been identified, the well will be completed and development of the well will be implemented within approximately 24 hours (allowing sufficient time for the annular grout seal to set-up). The development process will initially focus on extracting groundwater from the well as opposed to surging. Depending on the productivity of the well, it will be pumped at a continuous rate for one to two hours with the objective of punging the well and surrounding water-bearing zone of water that may have been introduced from above during drilling.

In addition to the above, there is currently no indication that there are DNAPLs present along the back property line. The constituent with the highest concentration at DMW-9, for example, is 1,2-dichloroethene (total) at 1400 ppb. (November 1998 data). The solubility of cis-1,2-dichloroethene is 800,000 ppb and trans 1,2-dichloroethene is 600,000 ppb. A pplying a worst case assumption that the 1400 ppb is all trans, and using the rule of thumb that concentrations over 1% of the solubility limit suggest the presence of DNAPL, the concentration in DMW-9 is well below the 1% criteria of 6,000 ppb. (1% of 600,000).

Last, there is currently an existing location closer to the suspected source area (well DMW-6) that bridges the deep gray shale and forms a continuing conduit between the lower principal aquifer and the deep bedrock. The deep bedrock is documented to contain total volatile organic concentrations as high at 1,500 ppb (DMW-8 November 1998 data).

For the above reasons, we believe that the deep wells can be installed as proposed without posing an unacceptable risk to the deep rock water-bearing zone.

The above was discussed during a conference call on February 14, 2001, among representatives of USE PA, de maximis, inc. and Brown and Caldwell. During the conference call the USE PA indicated that it had considered all of the above, but would be requiring the use of multiple casings. Discussion ensued without resolution; however, Brown and Caldwell offered an alternative approach, namely, a single casing to the deep gray shale. The USE PA's hydrogeologist was not available for the conference call and will not be available until the week of February 19, and as a result no decision was made regarding this proposal. The USE PA agreed to consider this alternative and Brown and Caldwell agreed to describe the concept in an e-mail.

Note: the packer test interval is ten feet and this will be corrected in Section 5.2.5 of the SAMP.

Comment:

W-19 Page 3-13, Section 3.6.1, Static Water Level Measurement. EPA's comment was partially addressed. Although the rationale for installing data loggers in the five wells identified in the second paragraph of this section was explained, EPA had requested that data loggers be installed in three to five additional monitoring wells (see May 1, 2000 letter).

Response:

Data logger installations had been previously added to three wells for the water level measurements during pumping (i.e., C-6, DMW-9, and MW-202L). We had considered that three additional wells with data loggers would not be necessary during the measurement of static conditions since the objectives are to confirm recovery after shutdown of pumping well C-1 and document antecedent conditions (e.g., barometric efficiency). However, we agreed to install the data loggers for static conditions on the same three additional wells (i.e., C-6, DMW-9, and MW-202L).

As previously noted, based on the proposed, revised locations of the three new extraction wells, the monitoring wells with data loggers during pumping have been changed to MW-201UP, MW-201P, MW-201L, C-6, DMW-9, MW-202L, C-7, and DMW-10. These wells represent those dosest to the pumping wells and include two dusters of three wells (wells in the Upper Permeable, Principal and Deep Bedrock), and one duster of two wells (Upper Permeable and Principal) located along the back property line.

Comment:

W-20 Page 3-14, Section 3.7.1, Groundwater Containment System. This comment was partially addressed. It is stated that water level measurements will be collected daily when pumping the extraction wells EX-1, EX-2 and EX-3. Continuous water levels should be measured in select wells using pressure transducers (see comment G-2 above). As stated in EPA's previous comments, water level measurements should be collected at more frequent intervals (possibly every 2 to 4 hours) immediately after initiation of pumping and with every pumping rate change until a dynamic steady-state condition is reached. The monitoring interval can then be gradually increased in a step-wise manner to once daily. The suggested approach will provide more useful data.

Response:

At the January 23 meeting we discussed the primary purpose of the water level monitoring, namely, wrifying steady state conditions and zone of capture. In this win, more frequent water levels will not add significant value but will add significant difficulty given the large number of wells involved. We agreed that the program as currently contained in the RDWP is adequate.

Comment:

It is stated in this section that water quality samples will be collected at each of the three extraction wells following the start of pumping and immediately prior to shutting off the pumps. Water quality samples should be collected of the extracted groundwater from each pumping well at least once per day.

Response:

At the January 23 meeting, we discussed the limited value of more frequent samples (i.e., total extent of aquifer influence will still be nominal, groundwater characteristics are fairly consistent at the site). For these reasons, USEPA said that sampling frequency could be at the discretion of the Group.

Comment:

This section requires more detail as outlined in comment G-2 above. The document indicates that additional monitoring wells will be installed either on site or off site based on the observed system response to pumping in the monitoring well network. If this is the case, the Chemsol ERT should explain whether the aquifer response tests will be repeated after additional wells are installed.

Response:

It was darified during discussion at the January 23 meeting that aquifer testing will be an iterative process if needed to define capture. This will be further darified in the RDWP.

Comments:

- W-21 Page 3-17, Section 3.8, Survey. This comment was adequately addressed.
- W-22 Page 3-18, Section 3.10, Piezometers. This comment was adequately addressed.
- W-23 Page 3-19, Section 3-10, Water Quality Data. This comment was adequately addressed.
- W-24 Table 3-1. This comment was adequately addressed.
- W-25 Figure 3-3. This comment was adequately addressed.

Appendix A - Sampling, Analysis, And Monitoring Plan (SAMP)

A-1 This comment was adequately addressed.

SAMP Section 4 - Site Management

All comments were adequately addressed.

SAMP Section 5 - Field Equipment and Procedures

Comment:

A-2 <u>Page A5-1, Section 5.2, Subsurface Drilling, Sample Collection, and Well Installation.</u> See comment A-2 above. It is recommended that previous drilling logs be reviewed to determine the best method to perform well installation.

Response:

See response to comment W-18. It was agreed that no finther action regarding this comment would be necessary.

Comments:

- A-3 Page A5-7, Section 5.2.2, First bullet. This comment was adequately addressed.
- A-4 Page A5-11, Section 5.2.4, Caliper Logging. This comment was adequately addressed.
- A-5 <u>Page A5-13, Section 5.2.5, Packer Testing Procedure.</u> This comment was adequately addressed.
- A-6 Page A5-15, Section 5.2.6, Open Borehole, Bedrock Extraction Wells, Second Bullet. This comment was adequately addressed.
- A-7 <u>Page A5-16, Section 5.2.6, Open Borehole, Bedrock Extraction Wells, First Bullet.</u> This comment was adequately addressed.

Comment:

A-8 Page A5-16, Section 5.2.6, Single Cased Bedrock Monitoring Wells. This comment was adequately addressed. As stated previously, the third bullet refers to bentonite pellets. EPA has noted previously that NJDEP does not allow the use of bentonite pellets. A double-zero fine sand seal is placed directly above the filter pack. Cement-bentonite grout is then tremied above that seal. EPA also recognizes that the Chemsol ERT disagrees with the NJDEP's position on bentonite pellets.

Response:

The USEPA has verified that the use of bentonite pellets is acceptable to the Agency. The RDWP will be provided to the NJDEP for review, but no further action is anticipated in regard to this comment.

A-9 <u>Page A5-17, Section 5.2.6, Double Cased Bedrock Monitoring Wells.</u> This comment was adequately addressed.

Comment:

A-10 Page A5-18, Section 5.2.6, Double Cased Bedrock Wells, Fourth Bullet. This comment was adequately addressed. Please explain the apparent discrepancy concerning the interval for packer testing (the text in Section 5.2.5 on Pages A5-13 and A5-14 refers to five-foot intervals).

Response:

The correct interval is 10 feet and Section 5.2.5 will be corrected (typographical error). P:\^J\20541\RDWP\usepa groundwater comments response_chemsol rdwp.doc

Comments:

- A-11 Page A5-20, Section 5.2.6, Drilling Records. This comment was adequately addressed.
- A-12 <u>Page A5-20, Section 5.2.6, Construction Materials for Monitoring Wells.</u> This comment was adequately addressed.
- A-13 Page A5-21, Section 5.2.6, Grout. This comment was adequately addressed.
- A-14 <u>Page A5-22, Section 5.4, In Situ Hydraulic Conductivity Testing.</u> This comment was adequately addressed.
- A-15 Page A5-25, Section 5.5.1, Preparatory Office Activities, First Bullet (Sampling Sequence). This comment was adequately addressed.
- A-16 <u>Page A5-27, Section 5.5.3, Well Purging, Second Paragraph.</u> This comment was adequately addressed.
- A-17 Page A5-28, Section 5.5.4, Groundwater Sample Collection. This comment was adequately addressed.
- A-18 Page A5-29, Section 5.5.5, Equipment Instructions. This comment was adequately addressed.
- A-19 Page A5-35, Section 5.6, Surface Water Sampling. This comment was adequately addressed.
- SAMP Section 6 Field Sample Handling, Documentation and QA/QC
- A-20 <u>Page A6-2, Section 6.2.1, Sample Containers and Preservatives, First Paragraph.</u> This comment was adequately addressed.
- A-21 Page A6-3, Section 6.2.2, Sample Shipment. This comment was adequately addressed.
- A-22 Page A6-4, Section 6.3, Chain of Custody. This comment was adequately addressed.

Additional (new) Comments

Work Plan

Comment:

NW-1 Page 2-5, Section 2.2, Second Paragraph. The PDVS, as proposed, will not provide adequate data to conclusively establish containment of the contaminant plume. It must be stated that the groundwater extraction system will be modified (by the addition of wells, if appropriate) if, during the long-term monitoring program, it becomes evident that there is incomplete containment.

Response:

See response to comment G-5.

Comment:

NW-2 Page 2-10, Section 2.2.2, First Paragraph. It is proposed that the system design will be modified, if necessary, during the PDVS to establish complete containment of the groundwater plume. Without the appropriate monitoring network, this will not be possible. Also, since the extraction wells will be tested together (well EX-1 pumping first and then EX-2 and EX-3 being subsequently added), it will be difficult to unambiguously identify the influence from the individual pumping wells especially in the absence of a comprehensive monitoring well network.

Response:

A greed at the January 23 meeting that confirmation that the aquifer testing program will be iterative as needed to verify capture addresses this issue (see comment W-20).

Comment:

NW-3 Page 4-2, Section 4.1.1. The preliminary design deliverables should include:

- An evaluation of the groundwater data and nature and extent of contamination in the various stratigraphic units.
- PDVS findings including the data gathered during the pumping tests, analyses and computations and the technical justification for the proposed extraction system design. The analyses presented should include details on how containment will be achieved in each of the various stratigraphic units and identify the specific monitoring wells that were used to establish complete containment.
- Details concerning the determination of the practical capacity of the existing treatment system and the measures for expanding it (if deemed necessary), including supporting design computations.

Response:

This information is currently discussed in Section 3.0 of the RDWP. A discussion of the above will be added to Section 4 to further darify.

Comment:

NW-4 Page 4-3, Section 4.1.2. The engineering drawings should also include well construction details.

Response:

This will be added to the discussion in this section.

Appendix A - SAMP

Comment:

NA-1 <u>Page A-iv, Table of Contents, List of Figures</u>. Typographical error. For Figure 5-1, the title should refer to "pressure" test instead of "presser" test.

Response:

This typographical error will be corrected.

Brown and Caldwell

Remedial Design Work Plan For The Chemsol Inc. Superfund Site

December February 20002001

REMEDIAL DESIGN WORK PLAN FOR THE CHEMSOL INC. SUPERFUND SITE

(Submitted Pursuant to Paragraph 32 of the Consent Decree, entered January 26, 2000, and the April 24, 2000 Correspondence from USEPA Region II Administrator)

Prepared for:

Chemsol Inc. Superfund Site PRP Group

Prepared by:

Brown and Caldwell 440 Franklin Turnpike Mahwah, New Jersey 07430 (201) 818-6055

18056.002

December 2000 February 2001

DISTRIBUTION LIST

Nigel Robinson

USEPA

Maheyar Billimoria

TAMS

Timothy Roeper Gary DiPippo Brown and Caldwell Brown and Caldwell

D. Rick Davis

E-Lab

AS OF DECEMBER 2000, THIS DOCUMENT APPLIES TO IMPLEMENTATION OF THE SOILS INVESTIGATION ONLY. ISSUES RELATED TO GROUNDWATER WILL BE REVISED/AMENDED AND APPROVED IN THE FUTURE. THE BIFURCATION OF THE SOILS AND GROUNDWATER REMEDIAL WORK ELEMENTS IS AT THE REQUEST OF THE USEPA AS NOTED IN COMMENTS DATED OCTOBER 24, 2000.

TABLE OF CONTENTS

				<u>Page No.</u>
1.0	INT	RODUC	CTION	1-1
	1.1	Docur	ment Format	1-4
	1.2	Projec	et Organization	1-5
2.0	TEC	HNICA	L APPROACH	2-1
	2.1		Pelineation Program	
	2.2	Pre-D	esign Verification Study	2-4
		2.2.1	Conceptual Hydrostratigraphic Model	
		2.2.2	Groundwater Extraction Wells	2-7
•	2.3		ing Site Investigation Work	
	2.4 2.5		tial Influence from The Elizabethtown Water Company Main Indwater Treatment Plant Evaluation	
	2.6		1B Cultural Resources Survey	
	2. <u>7</u> 5		erables	
3.0	PRE-	DESIG	SN INVESTIGATION (PDI) SCOPE	3-1
	3.1	Soil D	elineation	3-1
		3.1.1	Test Pit Program	3-3
	3.2	Charae	cterization of Surface Water and Sediment Quality	3-3
	3.3	Hydro Proper	ologic and Water Quality Data Collection (Southern Off-Siterty)	3-4
		3.3.1	Locate Well MW-104	3-4
		3.3.2	Groundwater Quality Sampling	3-5
		3.3.3	Long-Term Water Level Monitoring	3-5
	3.4		ndwater Treatment Plant Evaluation	
	3.5	Drillin	ng and Well Installation	3-6
		3.5.1	Extraction Wells	
		3.5.2	Monitoring Wells	3-9
	3.6	6 Water Level Measurements		3-11
		3.6.1	Static Water Level Measurement	3-11
		3.6.2	Antecedent Water Level Conditions	3-12

TABLE OF CONTENTS (CONTINUED)

				<u>Page No.</u>
3.7	Pre-D	Design V	Verification Study	3-12
		3.7.1 3.7.2	Groundwater Containment System Evaluation of Wells TW-4 and TW-5	
	3.8	Survey	y	3-14
	3.9		ndwater Quality Characterization	
	3.10	Evalua	ation of Potentially Leaking Waterline	3-15
	3.11	Phase	1B Cultural Resource Study	3-17
4.0	REM	EDIAL	DESIGN ACTIVITIES	4-1
	4.1	Prelim	ninary Remedial Design Reports	4-1
		4.1.1	Engineering Reports	4-2
		4.1.2	Engineering Drawings	4-3
		4.1.3	Technical Specifications	
		4.1.4	Draft Remedial Construction Schedule	4-4
	4.2	Final I	Remedial Design Reports	4-4
		4.2.1	Engineering Report	
		4.2.2	Engineering Drawings	4-6
		4.2.3	Technical Specifications	4-7
		4.2.4	Construction Quality Assurance Project Plan (CQAPP)	4-6
		4.2.5	Wetlands Mitigation Plan	
		4.2.6	Quality Assurance Project Plan for Long-Term Monitoring	4-7
		4.2.7	Proposed Remedial Construction Schedule	4-8
		4.2.8	Remedial Construction Cost Estimate	4-8
5.0	REM	EDIAL	DESIGN SCHEDULE	5-1
APP	ENDI	CES		
App App	endix / endix I endix (endix I	3 - Q C - E	ampling Analysis and Monitoring Plan (SAMP) Quality Assurance Project Plan (QAPP) Health and Safety Contingency Plan (HASCP) November/December 1998 Water Quality Data	

LIST OF TABLES

Table No.	<u>Title</u>	Follows <u>Page No.</u>
1-1	Location of QA/R-5 Elements Within the Chemsol RDWP Documents	1-4
3-1	Type of Sampling at Soil Boring Locations	3-1
3-2	Target Depths of Proposed Wells	3-7
3-3	Wells to be Monitored During PDVS	3-12

LIST OF FIGURES

Figure No.	Title	Follows Page No.
1-1	Site Location Map	1-1
1-2	Site Map	1-1
1-3	Organizational Chart	1-6
2-1	Projected Bedrock Cross Section	2-6
2-2	Potentiometric Contour Map, Wells Screened in the Overburden Zone, August 29, 1994July 20, 1999	2-7
2-3	Potentiometric Contour Map, Wells Screened in the Upper Permeable Aquifer, August 29, 1994 July 20, 1999	2-7
2-4	Potentiometric Contour map, Wells Screened in the Upper Principal Aquifer, August 29, 1994July 20, 1999	2-7
2-5	Potentiometric Contour Map, Wells Screened in the Lower Principal Aquifer, August 29, 1994July 20, 1999	2-7
2-6	Conceptual Hydrogeologic Cross-Section A-A', July 20, 1999	2-7
2-7	Conceptual Hydrogeologic Cross-Section B-B', July 20, 1999	2-7
2-8	Approximate Area of Phase 1B Cultural Resource Survey	2-7
3-1	Proposed Test PitSoil Sampling Locations Indicating PCB and Lead A	nalysis3-1
3-2	Proposed Soil Borings Near SB-74 and SB-76	3-2
3-3	Proposed Monitoring, Extraction Well and Surface Water/Sediment Sample Locations	3-4
5-1	Conceptual Schedule Remedial Action Design – Soils	5-1
5-2	Conceptual Schedule Remedial Action Design – Groundwater	5-1

1.0 INTRODUCTION

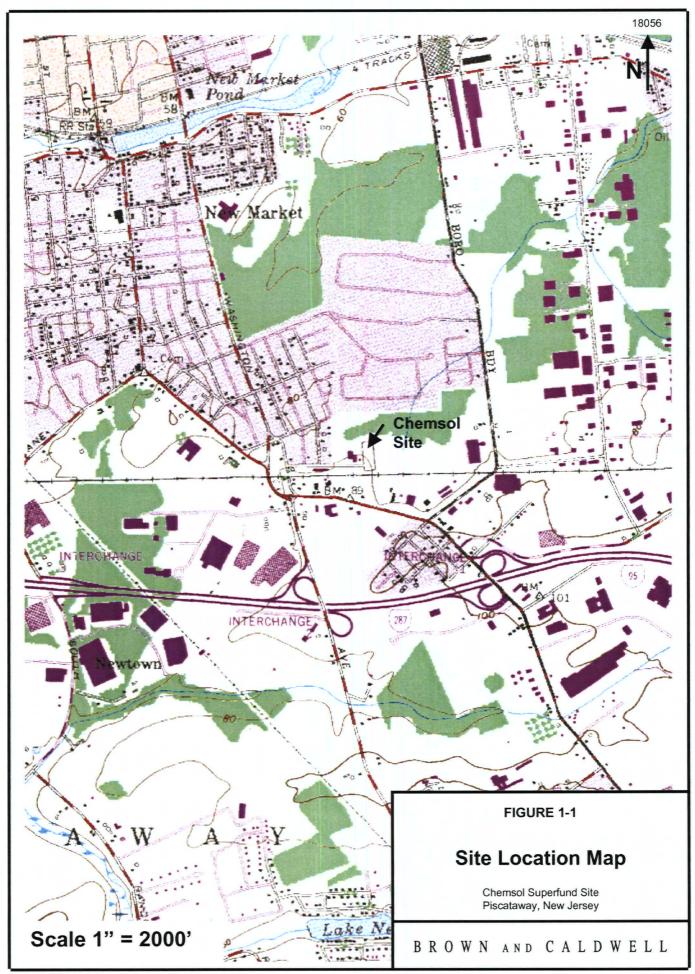
The Chemsol Inc. Superfund Site, currently owned by Tang Realty Inc. (TRI) is located at the end of Fleming Street in Piscataway, New Jersey (Figure 1-1). The site consists of two lots (Lot 1A and 1B) which together occupy approximately 40 acres (Figure 1-2). The majority of the site activities occurred on Lot 1B which is open and flat. Lot 1A, located north and east of Lot 1B, is primarily wooded. The site was operated during the 1950s and 1960s as a solvent recovery and waste processing facility by a chemical firm known at various times as Chemsol Corporation and Chemsol Inc. and was closed in 1964. The site was re-zoned in 1978, from industrial to residential, and in September of 1983 the site was placed on the Superfund NPL.

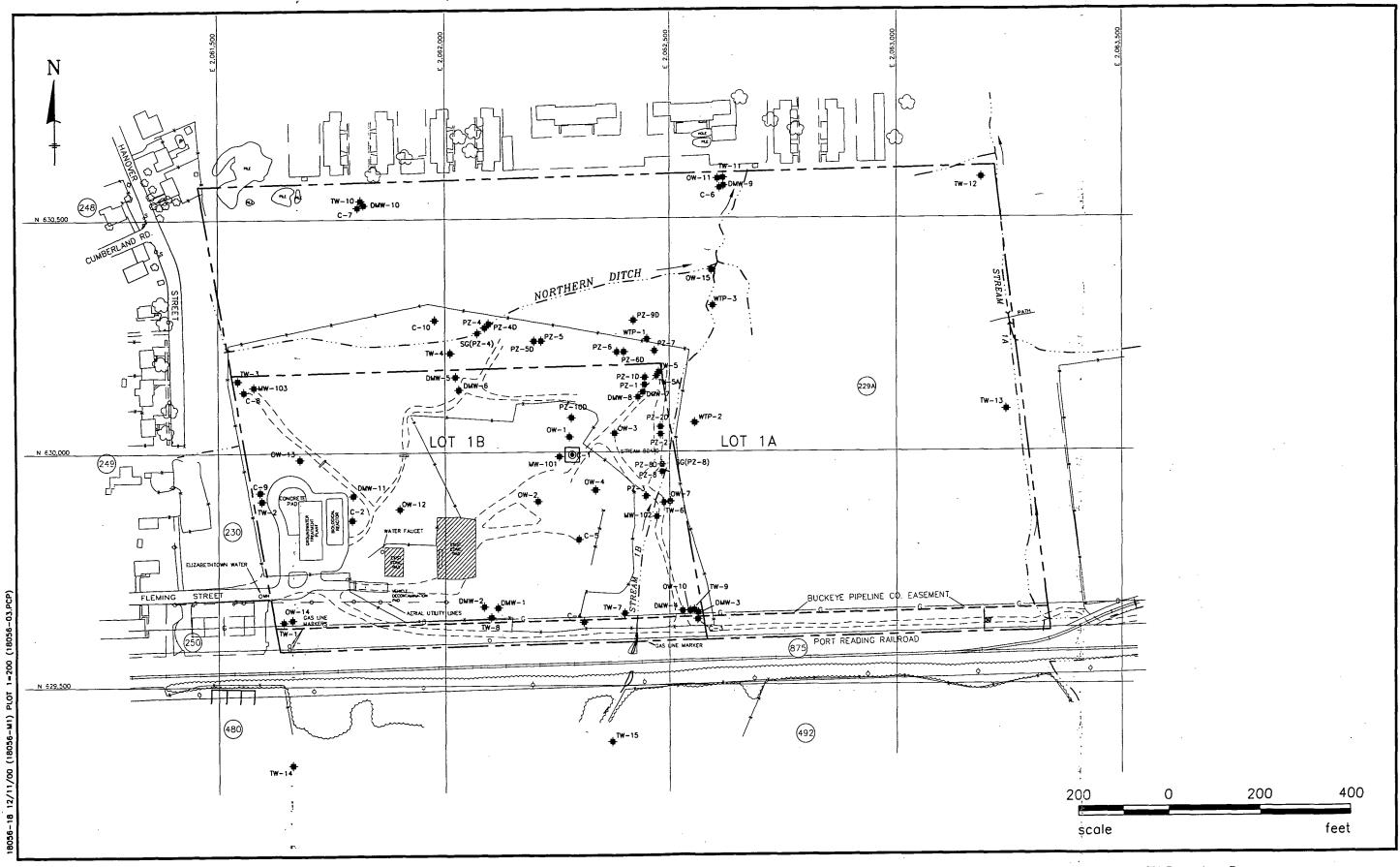
Since 1980 and to the present, a number of investigations have been conducted to assess the site geologic and hydrogeologic conditions and determine the extent of soil and groundwater contamination. These investigations have indicated that the soil contamination consists primarily of lead, polychlorinated biphenyls (PCBs) and volatile organics, while the groundwater contamination consists primarily of volatile and semi-volatile compounds.

In 1990 and 1991, EPA conducted a Focused Feasibility Study (FFS) for bedrock groundwater (Malcolm Pirnie, Inc., 1991). In September of 1991, based on the FFS, the USEPA selected an interim remedy for extraction and treatment of contaminated groundwater within the bedrock. The interim remedy was constructed by the PRP Group starting in the summer of 1993 and was completed in June 1994. The interim remedy is currently operating and will be the subject of further evaluation as a part of the remedial design efforts discussed subsequently.

Additional details related to the site history and previous investigations may be found in the Remedial Investigation Report, CDM Federal Programs Corporation, October 1996 and the Feasibility Study Report, CDM Federal Programs, June 1997.

The United States Environmental Protection Agency (USEPA) issued a Record of Decision (ROD) for the Chemsol, Inc. Superfund Site (the Site) in September 1998. The ROD





B R O W N A N D C A L D W E L L

FIG. 1-2 SITE MAP

established a remedial action for the Site. A Consent Decree between the Chemsol Inc. Superfund Group and the USEPA was entered with an effective date of January 26, 2000 and will govern the implementation of the remedial action for the Site. The scope and components of the implementation of the remedial action are specified in the Statement of Work (SOW) in the Consent Decree. This Remedial Design Work Plan (RDWP) has been prepared and is being submitted pursuant to the SOW.

The work described in the SOW includes performance of pre-design activities, a Remedial Design of the selected remedy, remedial construction of the remedial action, implementation of the long-term operation of the remedial action, and post-remediation monitoring. This RDWP contains a description of the Pre-Design Investigation (PDI) and the development of the Remedial Design (RD) for the site as provided for by the SOW.

The scope of the RDWP is largely defined by the SOW. The SOW defines the pre-remedial design activities developed for the site and specified in this RDWP.

The pre-remedial design activities, as described in the SOW, are summarized as follows:

• Collect one round of groundwater samples from existing wells to evaluate the current extent of groundwater contamination and the effectiveness of the interim pumping system. This task was completed in November through December, 1998 in accordance with an approved October 23, 1998 Scope of Work and the data were presented in the document entitled "Site-Wide Groundwater Sampling Data," Fall 1998, Chemsol Inc. Site, Piscataway, New Jersey (Eckenfelder/Brown and Caldwell, February 1999). A summary of the analytical results obtained from this and previous sampling rounds, as well as maps presenting the Total Volatile Organic (TVO) concentrations as measured from samples collected within each water-bearing zone in November/December, 1998, are provided in Appendix D. Further evaluation of these data will be provided as part of the forthcoming remedial design report (SOW – Section III.A).

- Sample existing wells to assist in determining whether impacted groundwater is leaving the site (SOW Section III.B).
- Perform a pre-remedial action characterization of PCB concentrations in surface water, sediment, and groundwater prior to implementation of the remedial action (SOW – Section III.C).
- Evaluate the existing groundwater treatment plant to determine its practical capacity (SOW – Section III.D).
- Conduct a Pre-Design Verification Study (PDVS) that includes the installation and testing of extraction wells and supplemental observation wells to verify, using the observational approach, that on-site containment of impacted groundwater can be achieved. Evaluate the potential for mass removal by pumping groundwater from existing wells (SOW – Section III.E).
- Provide a supplemental delineation of the horizontal extent of PCBs and Lead in surface soils (SOW – Section III.F).
- Provide a supplemental delineation of the vertical and horizontal extent of PCBs and VOCs in the vicinity of existing borings 74 and 76 (SOW – Section III.G).
- Perform a Stage 1B cultural resources survey (SOW Section III.H).

The remedial design activities, as described in the SOW, are summarized as follows:

 Prepare a design for the excavation and off-site disposal of impacted site soils and backfilling, grading and vegetating of the excavated areas (SOW – Sections IV.A and IV.B).

- Prepare a design for the augmentation of the existing groundwater extraction and treatment system (SOW – Section IV.C).
- Prepare a long-term monitoring plan to evaluate the effectiveness of the remedial action. The plan will address groundwater quality and containment as well as surface water and sediment quality (SOW – Sections IV.D and IV.E).

1.1 DOCUMENT FORMAT

The Consent Decree for the Chemsol Site provides various references regarding the format under which the RDWP is to be submitted. In an effort to be consistent with previous documents prepared for this site and provide for efficient preparation of the documents, this work plan was prepared consistent with the QAMS 005/80 Guidance Document (referenced in the Consent Decree) which calls for the submittal of a Remedial Design Work Plan (RDWP), Quality Assurance Project Plan (QAPP), and Sampling Analysis and Monitoring Plan (SAMP). In recognition of the format called for in the current QA/R-5 Guidance Documents, however, Table 1-1 identifies, to the extent practicable, the various QA/R-5 elements and the locations within the documents where the applicable information may be found. In addition, the documents are bound together so that they are all readily available to field and office personnel as needed.

The remainder of this report has been organized as follows:

- Section 2.0, Technical Approach presents the technical basis and rationale for the scope of work presented in the RDWP. This section emphasizes the basis for the work to be performed, rather than the specific details of the work, which follow.
- Section 3.0, Pre-Design Investigation (PDI) Scope provides a task-by-task description of the work to be performed, based on the technical approach presented in Section 2.0. This section, in concert with the Sampling, Analysis, and

TABLE 1-1

LOCATION OF QA/R-5 ELEMENTS WITHIN THE CHEMSOL RDWP DOCUMENTS

QA/R-5 Element	Location in Chemsol Documents
A 1 Title and Approval Sheet	QAPP - Appendix B
A 2 Table of Contents	RDWP, Appendices A, B and C
A 3 Distribution List	RDWP, QAPP - Appendix B
A 4 Project/Task Organization	
	RDWP Section 1.1, Document Format 1.2, Project Organization, 3.0 Access, 5.0 Schedule, QAPP - App. B Section 2.0, Organization and Responsibility
A 5 Problem Definition/Background	RDWP, Sections 1.0 Introduction and 2.0 Technical Approach
A 6 Project/Task Description	RDWP, Sections 3.0 Pre-Design Investigation Scope and 4.0 Remedial Design Activities
A 7 Quality Objectives and Criteria for Measurement Data	QAPP, Section 3.0 Quality Assurance Objectives SAMP, Section 6.1 Field QA/QC Samples
A 8 Special Training/Certification	RDWP, Section 1.2 Project Organization and HASP - Appendix C
A 9 Documents and Records	RDWP, Section 1.1 Document Format, SAMP, Section 4.3 Field Documentation, QAPP Section 7.0 Data Reduction, Validation, and Reporting
B 1 Sampling Process Design	RDWP, Section 3.0 Pre-Design Investigation Scope, SAMP, Section 2.0 Sample Location and Frequency
B 2 Sampling Methods	SAMP, Section 5.0 Field Equipment and Procedures
B 3 Sample Handling and Custody	SAMP, Section 6.0 Field Sample Handling, Documentation and QA/QC
B 4 Analytical Methods	SAMP, Section 7.0 Laboratory Analysis, QAPP Section 6.0 Analytical Procedures and Calibration
B 5 Quality Control	
,	QAPP, Sections 3.0 Quality Assurance Objectives, 5.4 Sample Receipt, 6.0 Analytical Procedures and Calibration, 8.0 Internal Quality Control Checks, 9.0 Performance and System Audits, 11.0 Corrective Actions, SAMP Section 6.0 Field Sample Handling, Documentation, and QA/QC

TABLE 1-1

LOCATION OF QA/R-5 ELEMENTS WITHIN THE CHEMSOL RDWP DOCUMENTS

QA/R-5 Element	Location in Chemsol Documents
B 6 Instrument Testing, Insp. And Maintenance	QAPP, Section 6.0 Analytical Procedures and Calibration, SAMP Section 4.4 Field Instrumentation
B 7 Instrument Calibration and Frequency	QAPP, Section 6.0 Analytical Procedures and Calibration, SAMP Section 4.4 Field Instrumentation
B 8 Inspection/Acceptance of Supplies	QAPP, Section 6.4 Inspection/Acceptance Requirements for Supplies and Consumables
B 9 Non-Direct Measurements B10 Data Management	Not Applicable QAPP Sections 5.4 Sample Receipt, 7.0 Data Reduction Validation and Reporting, 12.0 Quality Assurance Reports to Management, SAMP Sect. 4.3 Field Documentation, 6.3 Chain-of-Custody
C 1 Assessments and Response Actions	QAPP Section 9.0 Performance and System Audits, 11.0 Corrective Action
C 2 Reports to Management	QAPP Section 12.0 Quality Assurance Reports to Management
D 1 Data Review, Verification, Validation	QAPP Section 7.0 Data Reduction Validation and Reporting
D 2 Verification and Validation Methods	QAPP Section 7.0 Data Reduction Validation and Reporting
D 3 Reconciliation with User Requirements	QAPP Section 7.0 Data Reduction Validation and Reporting, 10, Calculation of Data Quality Indicators, 12.5 Usability Assessment

Monitoring Plan, provides the specifics of the work along with the procedures to be followed in implementing the work.

- Section 4.0, Remedial Design Activities describes the work to be performed to complete the remedial design for Remedial Work Elements I and II, including both preliminary and final remedial design reports pursuant to the requirements of the SOW. In addition, this section documents the deliverables that will be prepared in completing the design.
- <u>Section 5.0, Remedial Design Schedule</u> provides a schedule for the completion of the remedial design along with a preliminary for implementation of the remedy.

In addition to the above, <u>fourthree</u> appendices accompany the RDWP. Appendix A is the Sampling, Analysis, and Monitoring Plan (SAMP) that presents the specifics of sampling and monitoring (e.g., location, frequency, etc.) along with the procedures to be employed in performing the work. Appendix B is the Quality Assurance Project Plan (QAPP) that describes the quality assurance activities that will be undertaken for the sampling and analysis work to be performed. Last, Appendix C is the Health and Safety Contingency Plan that provides procedures to identify, evaluate and control potential hazards associated with the work and to provide contingency procedures in the event of an unforeseen condition or emergency. Appendix D, provides site specific data collected during previous work efforts such as groundwater sampling results and a summary of existing monitoring wells, including their screened interval, total depth and reference elevations.

These documents will be available to all personnel during sampling operations for use and reference. Any significant changes will be made in writing and sent to EPA for approval. Minor deviations will be communicated verbally to the EPA Project Manager and documented in the RDWP maintained on site.

Reports generated during this investigation will be subject to internal quality control checks and technical and QA review by EPA. All project documentation will be maintained in the

project files until the project is formally closed. Documents related to the project will be

maintained for a period of ten years following completion of the project.

1.2 PROJECT ORGANIZATION

The organizations and key individuals implementing the RDWP are illustrated in Figure 1-3.

The roles and responsibilities of the identified companies and individuals are as follows:

United States Environmental Protection Agency (USEPA)

Mr. Nigel Robinson will act as the Project Manager on behalf of the USEPA. In this role,

Mr. Robinson will be the point of contact with the federal government for the transfer of

information including progress reports, analytical data, etc. Mr. Robinson, on behalf of the

U.S. Government, will review the collected data to confirm that the work is completed in

accordance with the approved Work Plan and associated documents.

TAMS Inc.

Mr. Maheyar Billimoria will act as Project Manager on behalf of TAMS and as Oversight

Contractor for the USEPA. In this role, Mr. Billimoria will provide technical oversight of

the project and confirm that the work is completed in accordance with the approved Work

Plan and associated documents.

de maximis, inc.

Mr. William J. Lee will act as the Project Coordinator on behalf of the Chemsol PRP Group.

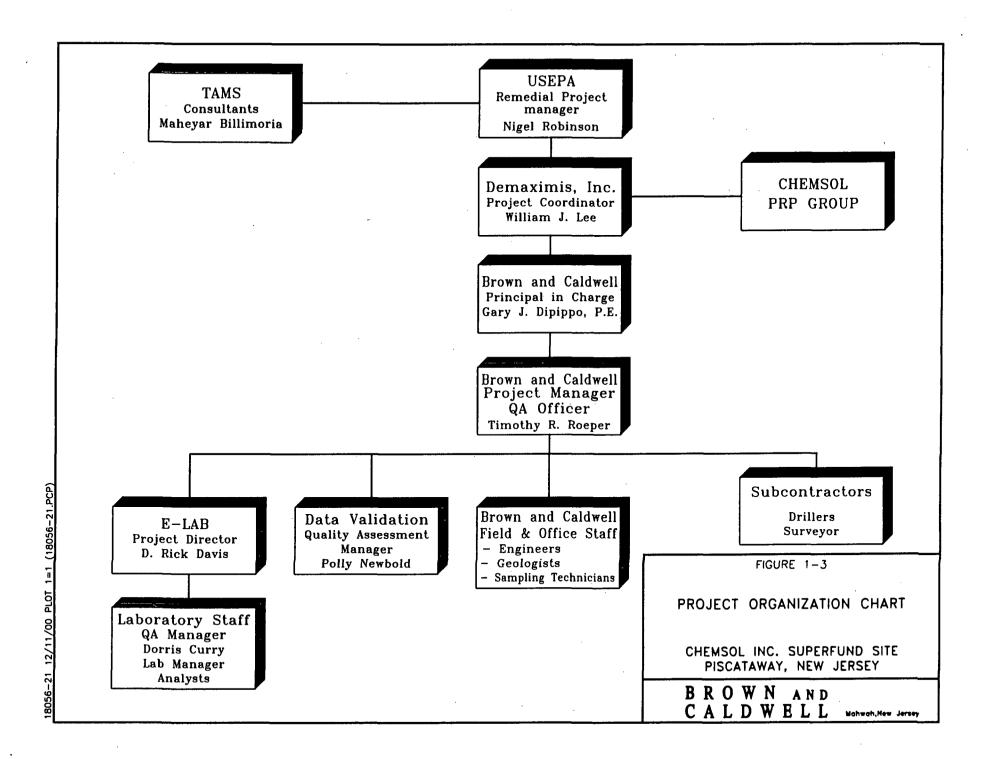
In this role, Mr. Lee will be responsible for overall project management and coordination

among the Chemsol PRP Group, USEPA, and Brown and Caldwell. In addition, Mr. Lee

will have overall responsibility for implementing the work in accordance with the approved

Work Plan, the Consent Decree and the Statement of Work.

1-6



Brown and Caldwell

Brown and Caldwell will act on behalf of the Chemsol PRP Group and under the direction

of de maximis, inc. to implement the RDWP.

Mr. Gary DiPippo will be the Project Director. Mr. DiPippo will be responsible for

maintaining communication with, de maximis, inc., the regulatory agencies and the Chemsol

PRP Group as well as overall responsibility for completion of the project in accordance with

the approved Work Plan.

Mr. Timothy Roeper will serve as the Project Manager and QA Officer. In this role, Mr.

Roeper will be responsible for coordination and implementation of the field activities called

for in the work plan as well as implementing the QA procedures defined in the QAPP.

Mr. DiPippo and Mr. Roeper will be assisted by various Brown and Caldwell Staff who have

been trained in their respective positions. There are no specialized training requirements for

the work performed under this Work Plan beyond those typically required for potentially

hazardous waste site investigations.

E-Lab

E-Lab will provide the laboratory analytical services associated with the RDWP.

Mr. D. Rick Davis is the Project Director and will assume overall responsibility for the

analytical testing described in the Work Plan. Mr. Davis will be assisted by Ms. Marcia

McGinnity as Lab Manager and Ms. Dorris Curry as QA Manager. QA/QC responsibilities

for these individuals are described in greater detail in the QAPP (Appendix B).

Trillium Inc.

Trillium Inc. will provide third party data validation services in accordance with EPA

Region II SOPs for data validation. Ms. Polly Newbold will assume overall responsibility for

1-7

the data validation process and verify that the data is validated in accordance with EPA Regions II SOPs.

Additional Subcontractors

- Additional subcontractors will be procured for the following services.
- A New Jersey-licensed well driller to perform soil borings and install monitoring and extraction wells;
- A New Jersey-licensed surveyor to locate soil borings, test pits, monitoring and extraction wells;
- A subcontractor to perform the Phase IB Cultural Resources Survey.

2.0 TECHNICAL APPROACH

A discussion of the technical approach and specific technical issues associated with the remedial design is presented in the subsections that follow. These include a clarification of the approach that is employed for several of the specific components of the PDI and the PDVS as they are presented in the PDI scope (Section 3.0).

2.1 SOIL DELINEATION PROGRAM

A soil delineation program has been proposed that addresses both the SOW requirements and observations made during a recent test pit program at the site that is described in additional detail below.

SOW Requirements

The requirements for soil delineation as set forth in the SOW are as follows:

- Further define the horizontal and vertical extent of surficial soils containing PCBs at greater than 1 ppm and lead at greater than 400 ppm prior to implementation of the selected remedy.
- Provide delineation of the vertical and horizontal extent of VOCs and PCBs within subsurface soils in the vicinity of borings 74 and 76.

The delineation program has been developed as a supplement to the existing RI data which, through the collection and analysis of samples at over 87 soil boring locations, defined the extent of soils containing PCBs at greater than 1 ppm and lead at greater than 400 ppm. The RI also identified the presence of VOCs, but concluded that soils containing elevated levels of VOCs were contained within the area identified for excavation based upon PCB and lead concentrations. The area previously identified for excavation is illustrated subsequently in Figure 3-1 and the sampling program described herein is based on the collection of additional samples at an approximate 50-foot spacing around the perimeter of the area

previously identified. This density of sampling will provide sufficient data for design of the soil excavation program and better define the extent of soils requiring excavation and disposal prior to implementation. The sampling program has been designed as follows:

• Along the northern and southern perimeters of the area previously designated for excavation based on PCB concentrations greater than 1 ppm (see Figure 3-1), sample locations were placed to fill in between existing boring locations where concentrations were below 1 ppm. This reduces the spacing to 50 feet along the presumed boundary, to confirm the limit of work.

• Along the eastern and western perimeters of the area previously designated for excavation based on PCB concentrations greater than 1 ppm (see Figure 3-1), the rationale noted above was applied. However, existing data points are limited in various locations (e.g., to the north on the western perimeter) and in these instances a double row of sampling locations were sited to fill in the data gaps.

• Along the perimeter of the area previously designated for excavation based on lead concentrations in excess of 400 ppm (in addition to PCBs), sample locations were placed to fill in between existing boring locations where concentrations were below 400 ppm (see Figure 3-1). This reduces the spacing to 50 feet along the presumed boundary, to confirm the limit of work.

The selection of sampling parameters at each individual location is based upon the previous sampling results (i.e., past results indicating elevated PCB concentrations will be sampled for PCBs while those indicating elevated PCB and lead concentrations will be sampled for both constituents).

In the event that the horizontal extent of soils requiring excavation is not defined by the sampling program described above, additional samples will be collected at appropriate field determined intervals (based on the data collected) not greater than 50 feet.

The details of the soil sampling program are provided in Section 3.1.

Test Pit Observations

A test pit survey, that included twelve (12) shallow test pits, was performed at the site in June

1999 to provide additional information for the development of the scope of the PDI and the

RD as it relates to soil excavation. Observations from these test pits indicate that depth to

weathered bedrock (i.e., competent rock fragments) is considerably more shallow than is

indicated from data obtained during the RI. In addition, observations during the excavation

of the test pits indicate the presence of VOCs in the weathered bedrock.

The initial objectives of the test pits were to estimate the infiltration rate of groundwater into

open excavations and to evaluate the ability to locate the depth to bedrock in selected

locations. The test pits were excavated using a small, rubber-tired backhoe to a depth of

generally 5.5 to eight feet below ground surface.

A thin, surficial soil layer was observed at most of the test pits underlain by residual soil

showing relic rock structure and finally weathered bedrock (i.e., competent rock fragments).

The thickness of the soil horizon was observed to range from not present to approximately

three feet. The material encountered in each of the test pits graded rapidly with depth from

residual soil to weathered bedrock and then to material that was sufficiently competent for

refusal of the excavation equipment being used.

Indications of VOCs were observed in the weathered bedrock zone underlying the surficial

and residual soil in numerous test pits. These VOCs were indicated by odors and detections

on a PID in the vicinity of the test pits. Material suggestive of light, non-aqueous phase

liquids was present within the weathered bedrock at two of the pits at the time of

excavation.

The findings of shallow bedrock in the test pits is significant in that it indicates much of the

"soil" envisioned for removal by USEPA's Feasibility Study (FS) (CDM, 1997) is actually

weathered bedrock. Based on these findings, and subsequent discussions with the Agency, it

2-3

was agreed that further horizontal delineation would be conducted as part of the RDWP (for PCBs and lead) and that the delineated area would be excavated to a depth of two (2) feet. The excavated depth of two feet will remove the contaminated soil, as called for in the FS, as opposed to deeper excavations that would be in weathered rock, although in some cases weathered rock will be removed at a depth of two feet. Excavation will occur to a depth of six feet at borings 74 and 76 to address the PCB and VOC detections in this area and will extend to a maximum limit, based on the RI data, of a 50 foot radius from each boring location (less if confirmed by additional sampling). The additional sampling program for the area surrounding borings 74 and 76 is described in detail in Section 3.1.

2.2 PRE-DESIGN VERIFICATION STUDY

The pre-remedial design activities, described herein, reflect an empirical, rather than predictive, approach to be followed for the implementation of a groundwater extraction system. The relatively complex, fractured rock hydrogeologic regime of the Site makes it quite difficult to reliably predict the necessary groundwater pumping rate to achieve the remedial objectives of containing contaminated groundwater on site. Understanding the required pumping rate is particularly critical at this site since the existing groundwater treatment plant has practical capacity limitations, as well as very stringent permit requirements. In view of the complex fractured rock regime, reducing the uncertainties surrounding required pumping rates to a degree that can reasonably be accommodated in the design process will require a Pre-Design Verification Study (PDVS). This study will involve construction of extraction wells and observation wells, followed by a controlled pumping of the extraction wells, coupled with monitoring of the actual zone of capture created by the extraction well system.

A numerical groundwater flow model has been previously developed and calibrated for the Chemsol Inc. Superfund Site Group (Eckenfelder Inc., October 1997) that was intended both for use as an interpretive tool and as a tool in designing a groundwater recovery system (the groundwater flow model is discussed further below). This calibrated model was developed based upon the Conceptual Hydrostratigraphic Model, described below, using hydrogeologic data collected during the RI. The layout and operation of the extraction and monitoring well network, as presented in Section 3.5, is based upon the results of the

groundwater flow model, as a starting point for the empirical approach described above. Based on data collected during the PDVS, the groundwater extraction system will be adjusted as applicable to achieve the objective of containment of contaminated groundwater on the property owned by the Owner Settling Defendant (as stated in the objectives of the SOW).

2.2.1 Conceptual Hydrostratigraphic Model

A review of the existing hydrogeologic data for the site has been conducted by Brown and Caldwell (BC) to develop a refined conceptual model of the groundwater flow regime. The current understanding represents a revision of the preliminary conceptual model that was presented in previous monitoring reports. The current conceptual model was revised on the basis of a review of the RI Report (CDM, 1996) and further review of previous site investigation data by both McLaren/Hart and AGES Corporation. This conceptual model may be subject to continued revisions based on, for example, additional field data obtained during the PDI.

The current understanding of the hydrogeologic flow regime is briefly stated below. Additional details, including a presentation of additional aquifer test analyses, are presented in a separate document titled "Technical Review of the Remedial Investigation Report, Chemsol Superfund Site" (Eckenfelder Inc., April 1997).

The site is underlain by the bedrock of the Passaic formation (formerly termed the Brunswick formation). The Passaic formation consists of reddish-brown mudstone (a non-fissile equivalent of shale), siltstone, and sandstone, which are interbedded with conglomeratic sandstones along the basin margins. Typically, these sediments form cyclic sequences of cross-bedded units that grade upward from coarser to finer grain size. The dominant facies in the formation are siltstone (60%) and mudstone (40%) with the coarser-grained sandstones and conglomerates comprising only a small fraction of the total percentage (Olsen, 1983). The dominant strike of the Passaic Formation is reported to be northeast to southwest with the beds dipping gently to the northwest at about 10 degrees.

The Passaic formation bedrock has been conceptually subdivided into six units on the basis of site stratigraphy and the observed aquifer response to the various pump tests that have been performed. These hydrostratigraphic units are depicted on Figure 2-1, and are described briefly, as follows:

- Overburden Water-Bearing Zone represents the uppermost water-bearing unit at
 the site and is contained within the composite unit represented by the thin
 overburden soils and the upper veneer of weathered bedrock.
- <u>Upper Bedrock Zone</u> is the bedrock below the overburden zone. Considerable vertical head loss is observed within this unit downward to the underlying Upper Permeable Aquifer.
- <u>Upper Permeable Aquifer</u> is a highly fractured, permeable bedrock zone that lies immediately above the upper gray shale. The maximum thickness of this unit may be up to approximately 40 feet <u>based upon the response</u> to <u>pumping of wells screened above the Upper Gray Shale. The thickness of this unit is dependent on the depth of weathering within the Upper Bedrock zone and is determined based upon how the unit responds to <u>pumping as opposed to geologic interpretation</u> (i.e hydrostratigraphy as opposed to geologic stratigraphy... <u>Previous estimates made by the USEPA based on geologic characterization placed the thickness of the unit at approximately 15 to 20 feet.</u></u>
- <u>Upper Gray Shale (Aquitard)</u> is a zone with relatively low permeability between the upper permeable aquifer and the Principal Aquifer.
- Principal Aquifer is comprised of the bedrock zone between the upper and deep gray shale beds with a thickness of approximately 180 feet. Slight downward gradients are observed within the Principal aquifer so that it has been subdivided into upper and lower portions for mapping purposes. In addition, wells screened

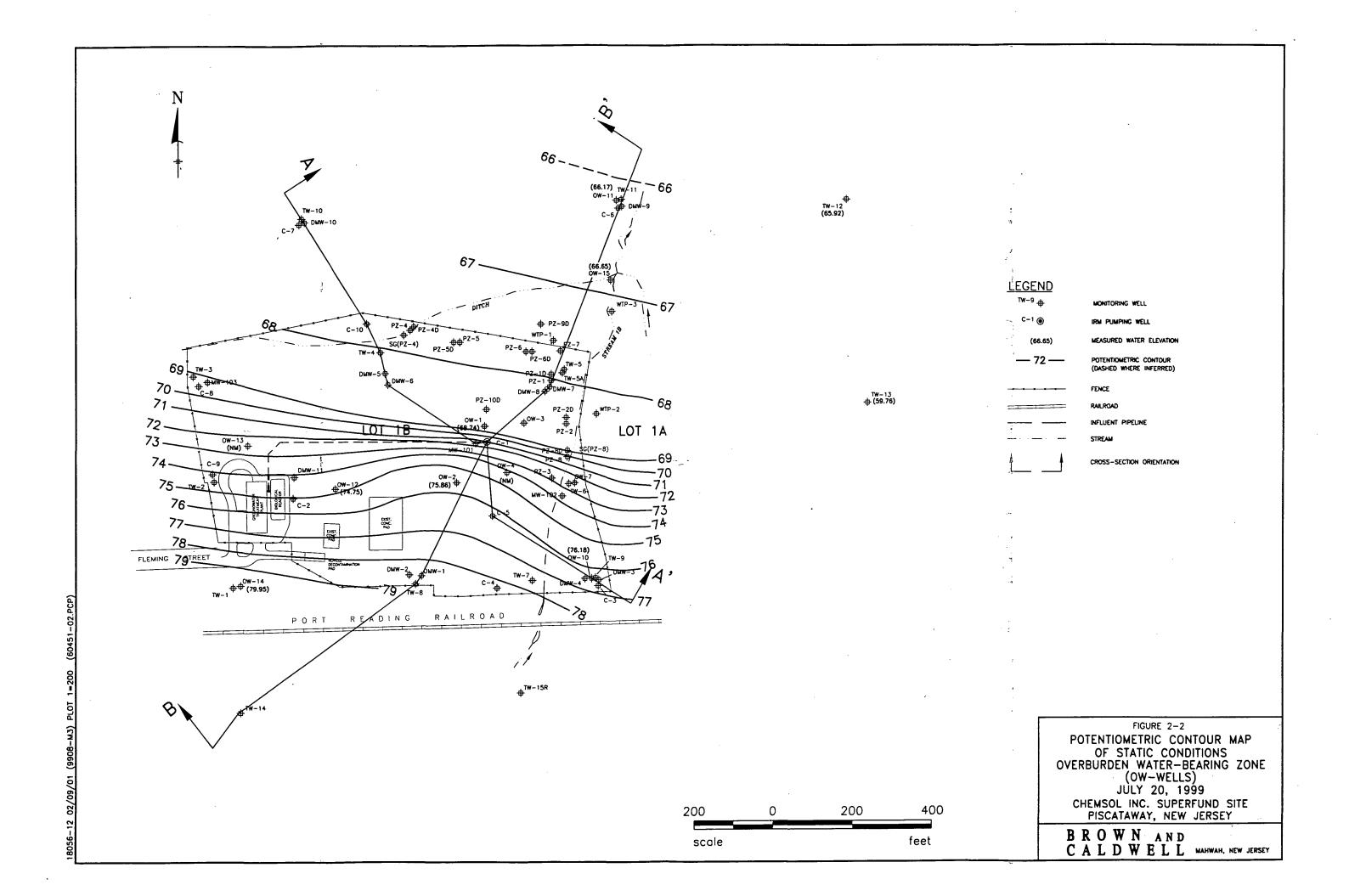
in the contiguous upper and deep gray shale units have been observed to be in hydraulic communication with the Principal aquifer and are included in the potentiometric mapping of this unit.

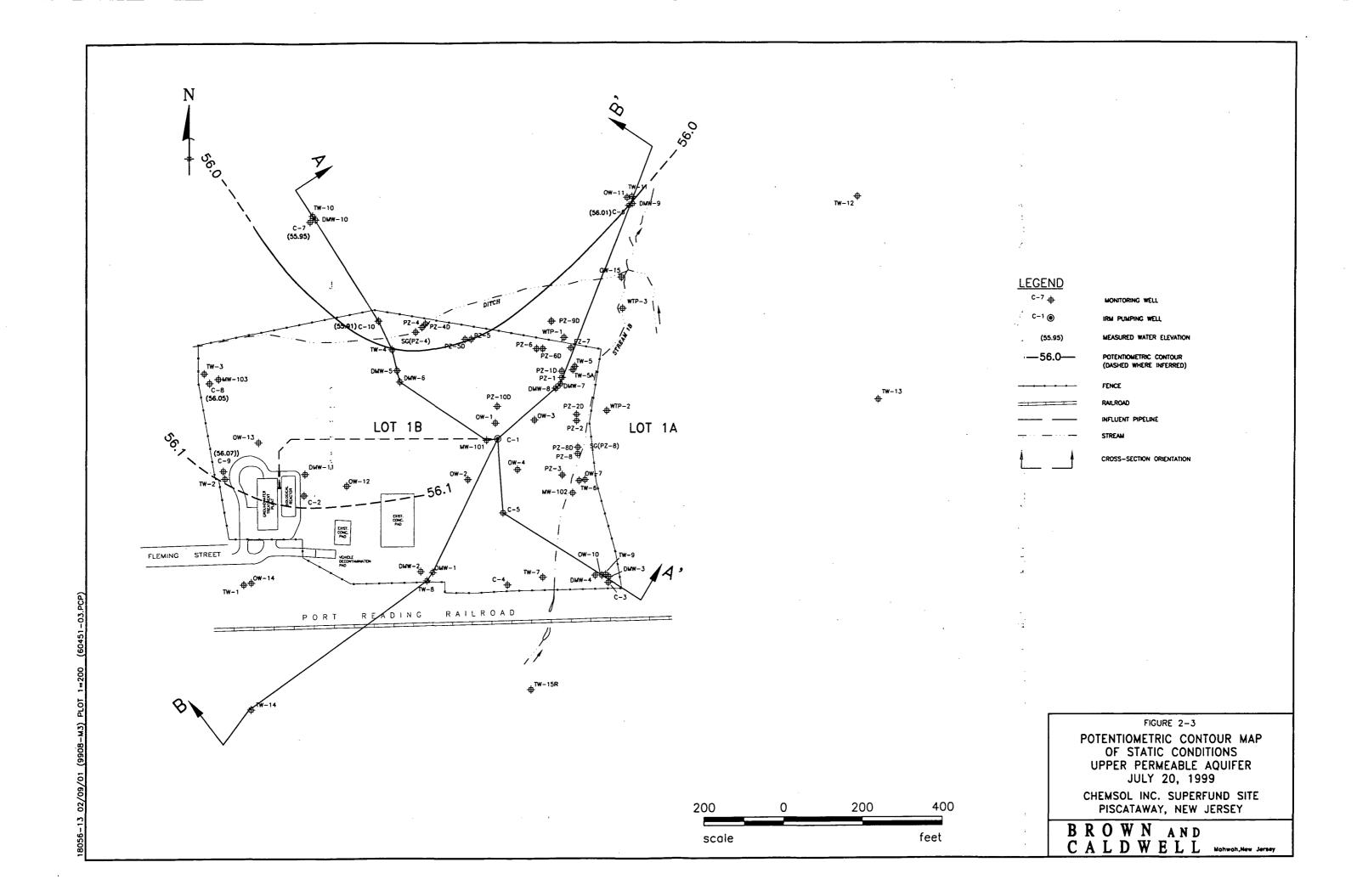
Deep Bedrock Unit - includes the bedrock below the deep gray shale. The deep gray shale provides some hydraulic separation between the Principal aquifer and the deep bedrock unit but has not been identified as a distinct aquitard due to the limited amount of data at this depth. It is anticipated that further information regarding the hydraulic properties of the deep gray shale will be obtained through the work proposed as part of this RDWP.

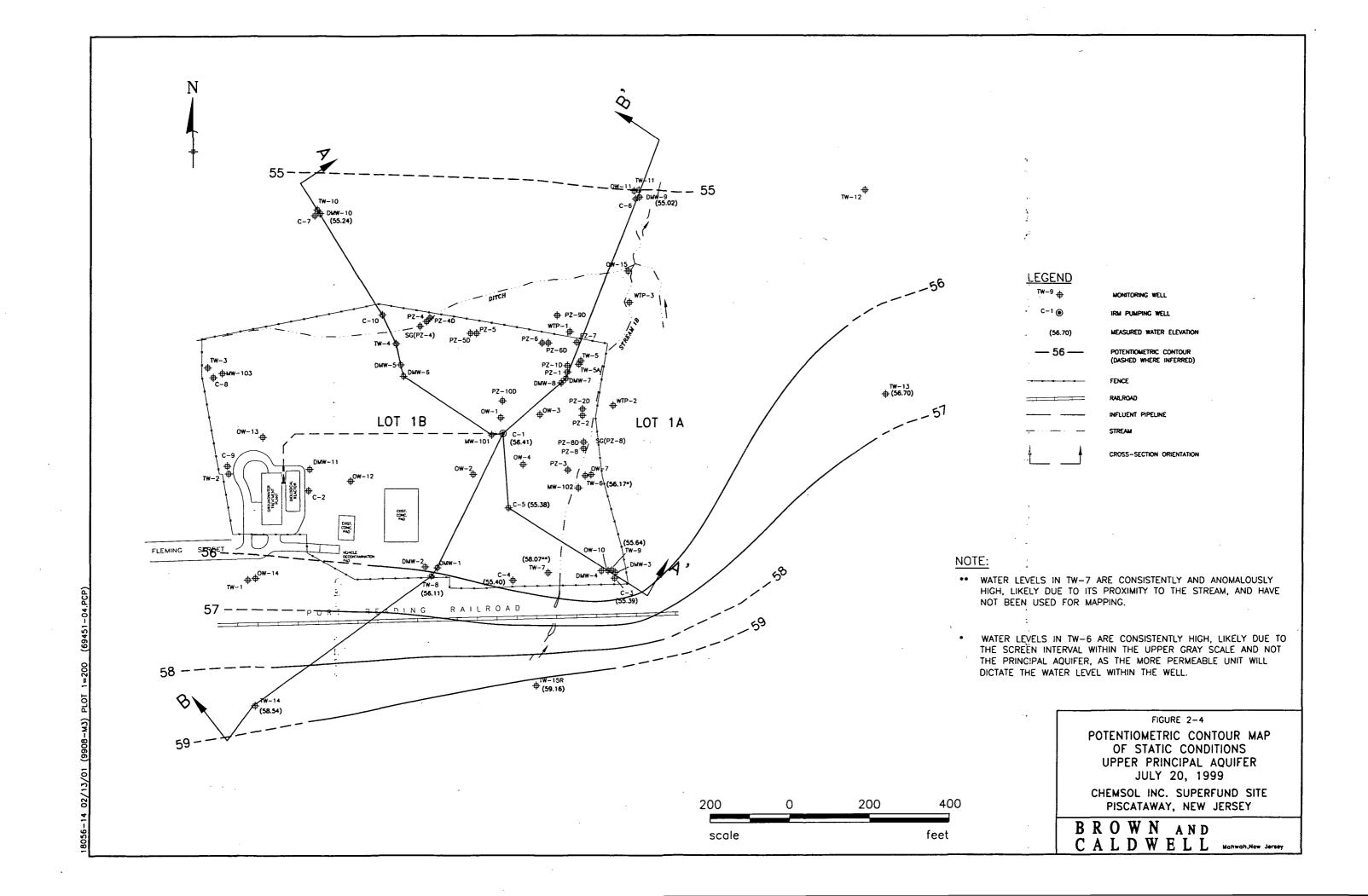
Plan-view potentiometric maps (Figures 2-2 through 2-5) have been prepared that depict static pre-pumping conditions using data obtained on August 29, 1994 July 20, 1999. These include maps for the hydrostratigraphic zones in which horizontal flow predominates including the Overburden zone, Upper Permeable aquifer, and the upper and lower portions of the Principal Aquifer. A potentiometric map of the Deep Bedrock Unit has not been prepared as the limited amount of data available at this depth suggests that vertical flow paths are predominant in this unit.

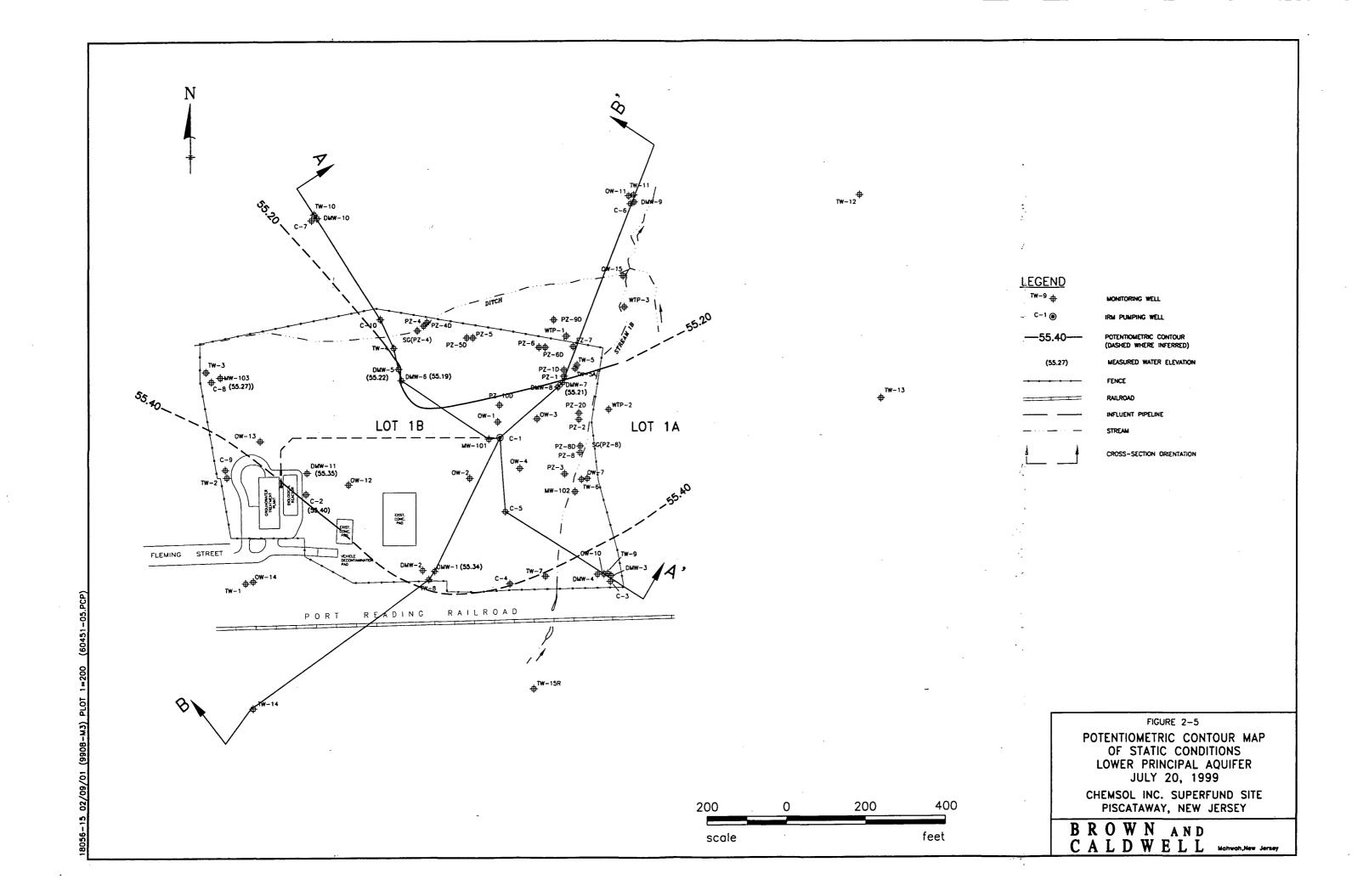
Hydrogeologic cross sections, depicting the static water level conditions as measured on July 20, 1999 are presented in Figures 2-6 and 2-7. As described above, these maps demonstrate that horizontal flow predominates in the Upper Permeable aquifer and the upper and lower portions of the Principal aquifer. Conversely, vertical flow is apparent in the Upper Bedrock, the Upper Gray Shale, and potentially within the Deep Bedrock Unit although there are an insufficient number of data points to draw strong conclusions at this time. The Overburden water-bearing zone is not illustrated in these cross-sections due to scale (i.e. the thickness of the overburden is too thin to be shown in detail).

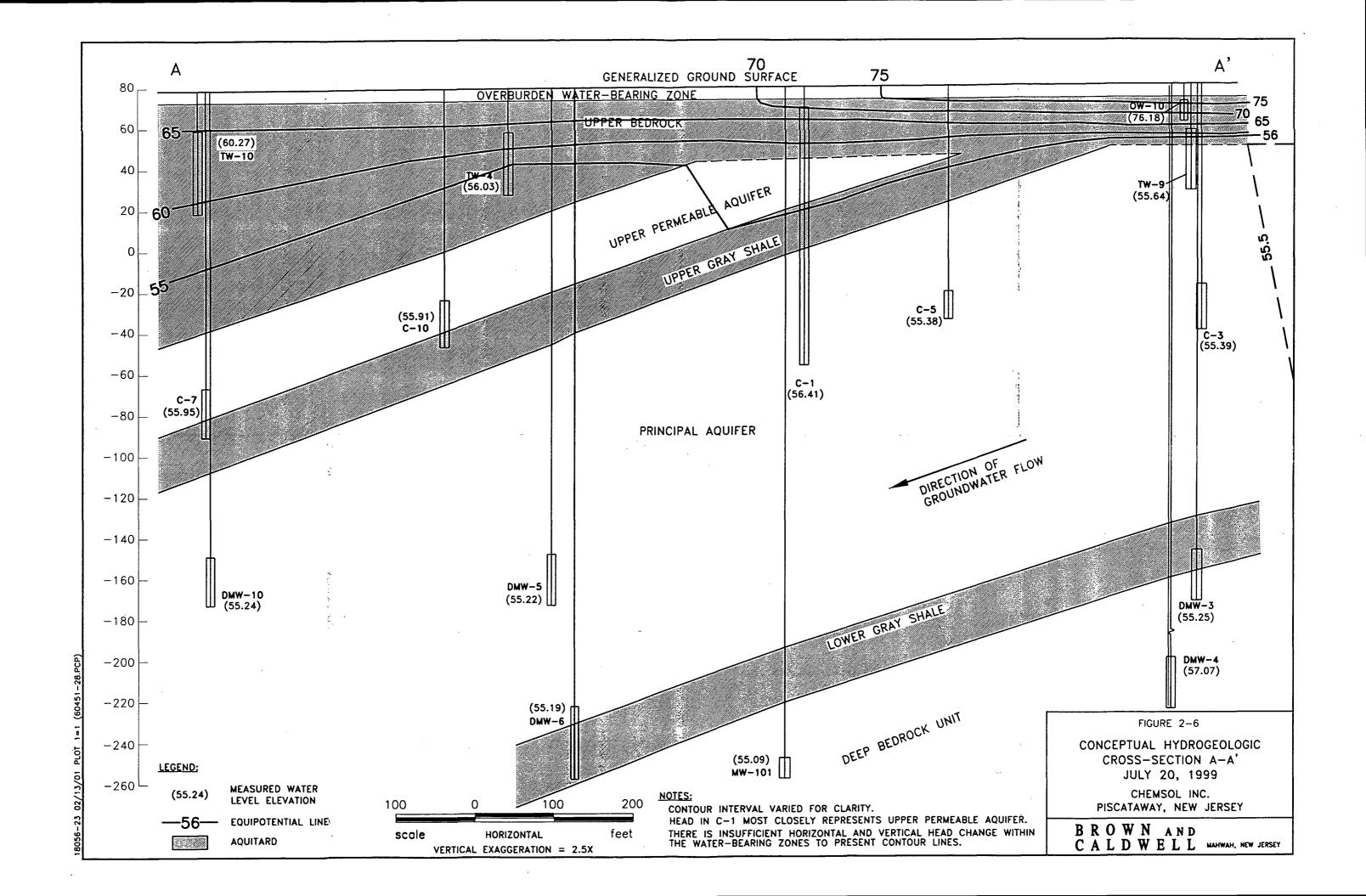
The predominant direction of horizontal groundwater flow prior to pumping in each of the zones is shown to be northward. This is somewhat different than the RI report. The differences between the current conceptual model and the RI report are due to a re-evaluation of which well data should be contoured together based on the above

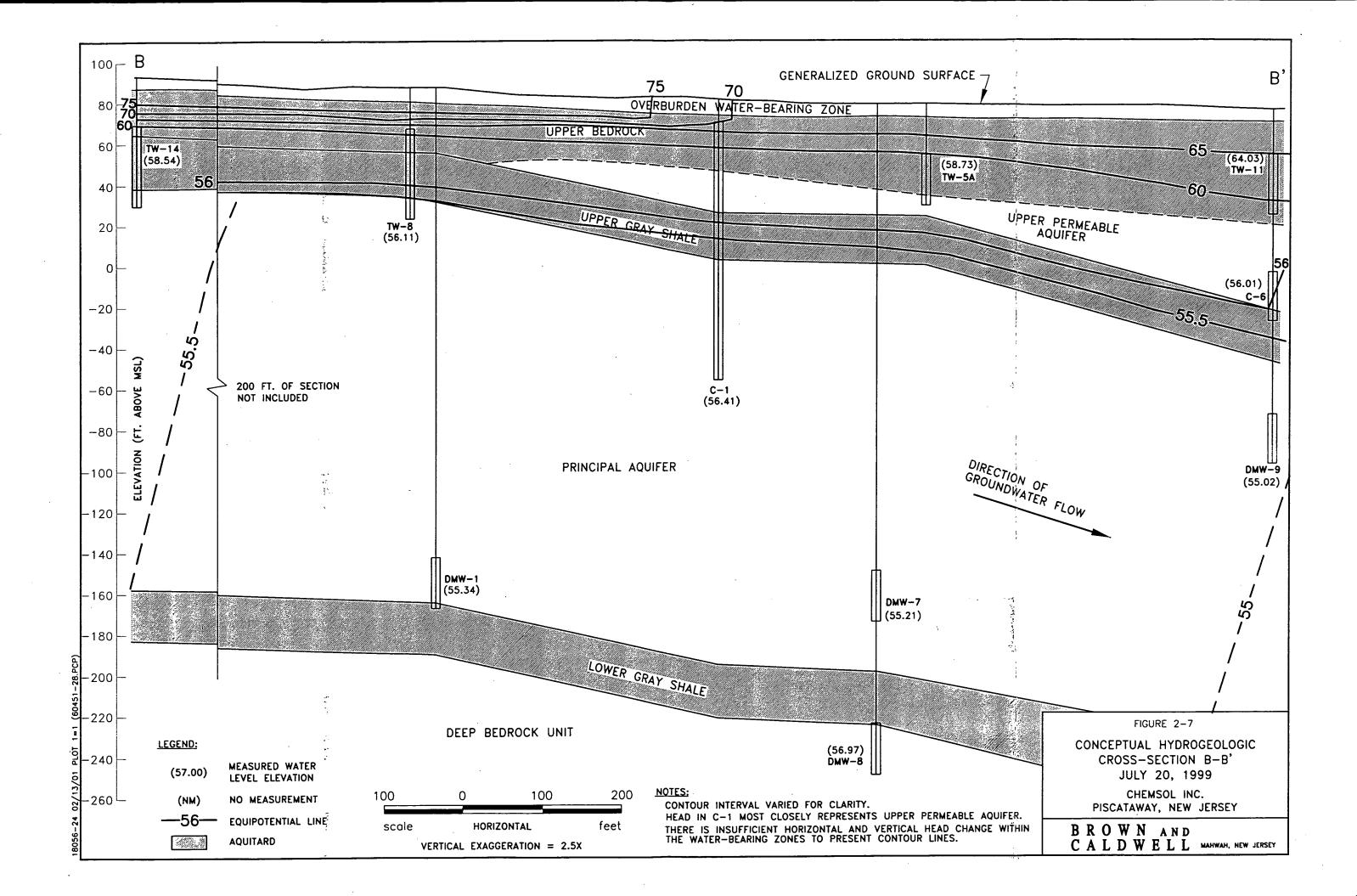


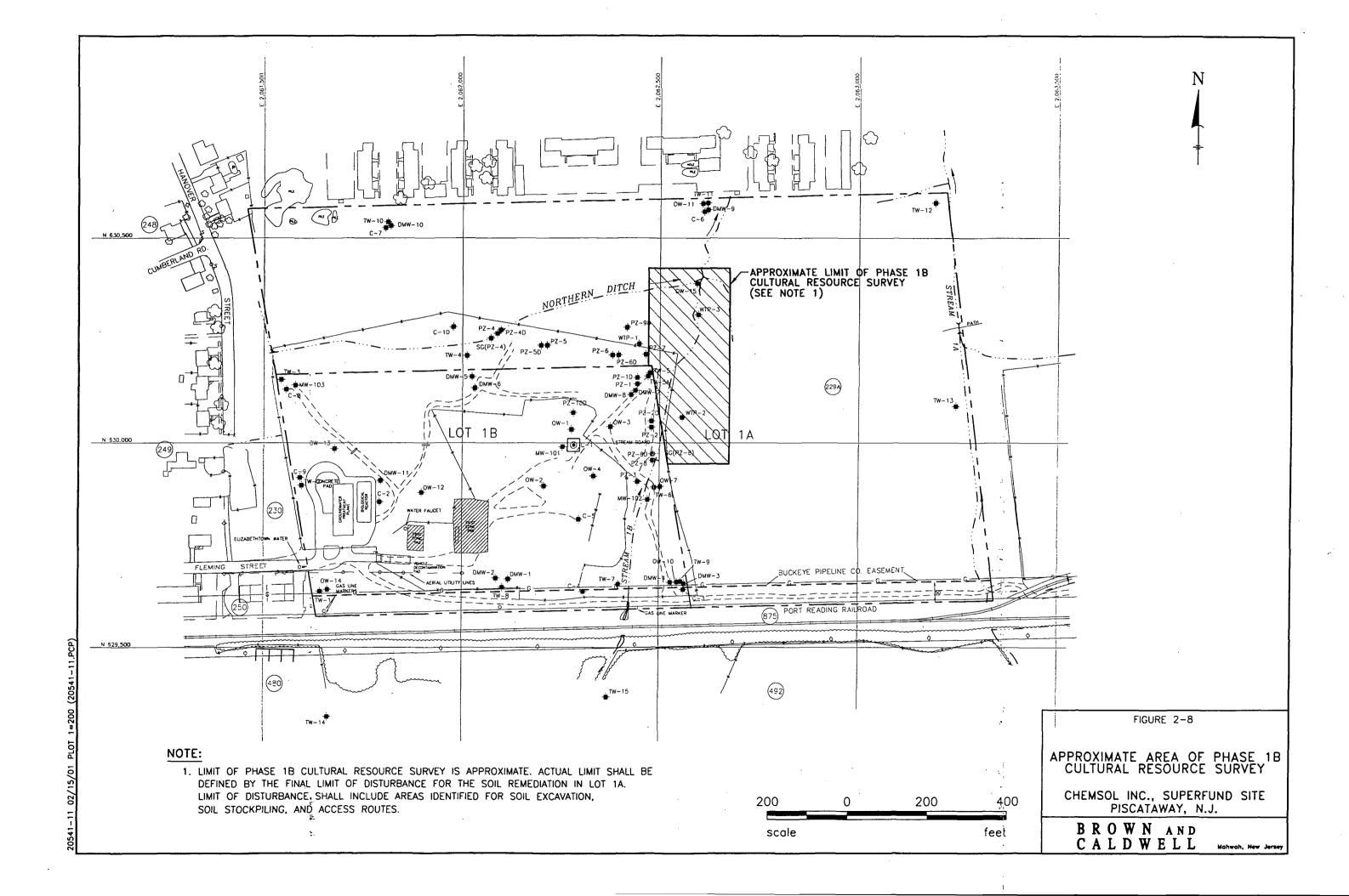












hydrostratigraphic units. The differences have been more completely described in the document titled "Technical Review of the Remedial Investigation Report, Chemsol Superfund Site" (Eckenfelder Inc., April 1997).

2.2.2 Groundwater Extraction Wells

As noted previously (Section 2.2) the layout and operation of the extraction well network for the PDI is based upon the groundwater flow model developed for the site (Eckenfelder Inc., October 1997). Briefly, the modeling was completed using MODFLOW and consisted of 5 layers representing the Upper Bedrock Zone, Upper Permeable Aquifer, Upper Principal Aquifer, Lower Principal Aquifer, and Lower Bedrock Aquifer (Deep Bedrock unit) with the Shallow Gray Marker Unit and the Deep Gray Marker Unit represented as leakance terms. The model was calibrated to steady state conditions by comparing the model predicted head configuration to the contoured groundwater elevation data collected on August 29, 1994. Transient calibration was thean conducted by simulating the aquifer test conducted by McLaren/Hart in 1993 at well C-1. The model was thus calibrated by demonstrating that the predicted head configuration, under both steady state and transient scenarios, represented a reasonable match to the field observed conditions.

The calibrated model was then used to select an extraction system design as the starting point for the PDVS in which the objective was to optimize the location and pumping rate of extraction wells to achieve the containment criteria. In accordance with the EPA selected remedy, these criteria included:

- Prevent/minimize off-site migration of groundwater contamination in the fractured bedrock aquifer.
- Contain the contaminated groundwater (that which is above Federal and State MCLs) on property owned by the Owner Settling Defendant from all depth zones.
 An element of this containment will be to reduce the mass of contaminants to the maximum extent possible.

The scenario meeting these objectives, and generally described in the Groundwater Modeling Report (Comments on the Feasibility Study and Proposed Plan, Appendix A, September, 1997), included a pumping well in the Principal Aquifer, the Upper Permeable Aquifer, and the Lower Bedrock Aquifer, each pumping at rate of 15 GPM, 5GPM and 5GPM respectively. This scenario is thus used as a starting point for the PDVS and includes the following:

- A replacement to extraction well C-1 (to be designated EX-1), screened across the
 thickness of the principal aquifer and pumped at approximately 15 gpm. The
 location of this well will be moved approximately 300 feet north of the current
 location as described in Section 3.0.
- One new well screened in the Upper Permeable Aquifer (EX-2) and pumped at approximately 5 gpm.
- One new well screened in the Lower Bedrock Aquifer (EX-3) and pumped at approximately 5 gpm.

The locations (discussed in Section 3.0) and pumping rates for these wells form the initial basis for the PDVS. Each of the wells will be brought on-line in a sequential manner and the resulting capture zone will be evaluated by measuring the water levels in the surrounding monitoring wells. The pumping rates in each of the wells will be varied, as needed, with the objective of containing the impacted groundwater on the site property as determined through observation of the surrounding monitoring wells through both automatic data loggers and manual measurements. In this manner, the design of the groundwater extraction and containment system will be based upon the observed responses to pumping and the system design will be modified accordingly, if needed, including additional wells that may be located either on or off the site property. Further, it is anticipated that additional information with respect to both distribution of organic compounds and zone of capture will be obtained from wells that will be installed as part of the OU-3 (off-site) investigation.

The locations of the three new extraction wells favor the downgradient perimeter of the site. Extraction wells closer to the downgradient limit of the site property provide added flexibility with respect to extending the zone of capture off-site, if needed. Under a separate operable unit (OU-3), an investigation will be undertaken to assess off-site groundwater characteristics. If this investigation were to indicate that extending the zone of capture off-site to the north would be beneficial, then wells at the site positioned to the north will offer this capability more so than wells centrally located (e.g., for a given pumping rate and drawdown the capture limit will extend farther off-site for a well positioned near the property boundary)

Such locations will optimize capture, the primary objective of the groundwater extraction system, but will also remove contaminant mass. The groundwater extraction system will remove groundwater from throughout the site. Seepage velocities in the bedrock formation are generally on the order of hundreds of feet per year. Thus, relatively minor adjustments in well location will not materially affect the removal of groundwater from throughout the site. In addition, there is evidence from the RI data that DNAPLs were present at this site. However, given the porous nature of the Passaic Formation, DNAPL remaining as free product is very unlikely. More likely, the DNAPL has been sorbed into the rock matrix. As a result, continued release of constituents from the rock will be a diffusion-controlled process that will be long lived and influenced very little by localized pumping in an effort to remove mass.

Given all of the above, locations to the north of the site for the extraction wells were selected to emphasize containment, the primary objective of the groundwater extraction system, while effecting mass removal to the extent practicable based on site conditions.

2.3 ONGOING SITE INVESTIGATION WORK

Several investigation tasks, as described in the PDI, are currently being conducted. These tasks are described briefly, as follows:

Evaluation of Wells TW-4 and TW-5

An evaluation of the potential enhancement of mass removal by pumping existing wells TW-4 and TW-5 is described in Section 3.7.2. Pumping of these wells has been completed and indicates that these wells are capable of yielding water at only a very low rate (~0.2 gpm). The fact that the yields of these wells are so low is not surprising given that these wells are installed in the Upper Bedrock zone, which has a correspondingly low transmissivity. Given the low potential yield of this unit, it is unlikely that substantial mass reduction can be achieved by pumping these wells. This will be further evaluated in the PDI by applying the sustainable yields determined from the test pumping and analytical data from sampling of these wells to estimate the mass removal rate, as described in Section 3.7.2.

Long-Term Water Level Monitoring

The long-term water level monitoring, as described in Section 3.3.3, was started in advance of the submittal of the RDWP. The objective of this monitoring is to identify seasonal and/or off-site influences (i.e., off-site pumping wells) that may result in groundwater flow reversals and, as a result, flow off of the property to the south. Groundwater flow is from the south to the north. However, in the past there have been off-site influences that could have affected this flow pattern (e.g., a water supply well on adjacent property to the south). While known off-site pumping influences have ceased, the water-level monitoring proposed herein is designed to confirm the absence of such influences as well as assess the potential for seasonal effects on groundwater elevations that could influence flow direction. The extended period of data collection will enhance the evaluation by allowing the data to be collected over various seasons as well as to assess whether there are intermittent influences that would not be indicated in a shorter term pumping. This water level monitoring is associated with the RDWP, and in particular with understanding groundwater flow to the south which had previously been influenced by off-site pumping farther to the south. This "long-term" monitoring to address the understanding of groundwater flow direction is in addition to the long-term performance monitoring for the groundwater extraction system that will be prepared as part of the remedial design.

2.4 POTENTIAL INFLUENCE FROM THE ELIZABETHTOWN WATER COMPANY MAIN

A large-diameter (48-inch) water main, owned and operated by the Elizabethtown Water Company, is located along the southern edge of the property (parallel to the railroad tracks). Available data suggest that this line may be leaking which, if proven, could impact the effectiveness of the groundwater remediation and affect water management during soil excavation. The leakage is indicated by observations made in utility excavations along the pipeline in the southwestern corner of the property in 1997 in which water was noticed to be present within the pipe backfill. Similarly, the recently conducted test pits at the site indicated higher water levels in the test pits located in the southeast corner of the property, near the pipeline, as compared to test pits located elsewhere. Based on this information, a task has been added to the PDI that will evaluate whether or not the pipeline may be leaking. This will include additional test pits, optional piezometers, and the collection and analysis of water quality samples that are described in more detail in Section 3.10.

2.5 GROUNDWATER TREATMENT PLANT EVALUATION

The existing groundwater treatment plant will be evaluated in the context of the information gained from the PDVS regarding groundwater pumping rate and groundwater characteristics. The approach to this evaluation will be to assess the ability of the existing plant to accommodate groundwater from the upgraded extraction system, and if this is not the case, identify the means by which the plant may be modified. The approach to the treatment plant evaluation may be illustrated as follows:

- Hydraulic capacity The pumps, piping, and treatment equipment will be assessed for hydraulic capacity by comparison to the groundwater extraction system flow rate. If portions of the plant were hydraulically inadequate to handle the flow, the following types of actions may be considered in the design:
 - Inadequate pipe capacity -- Increase pipe size as appropriate.

- Inadequate pump capacity Change out pumps, change out motors, change out impellers, convert to parallel operation on multiple units.
- Inadequate equipment capacity Change out equipment, add a parallel unit,
 convert units operated in series to operate in parallel based on individual
 capacity of multiple units.
- Treatment System Capacity The treatment equipment will be assessed to verify the ability to meet effluent limits based on projected influent characteristics. If equipment were inadequate to consistently meet effluent criteria, the following types of actions may be considered in the design:
 - Where multiple treatment units, such as granular activated carbon vessels,
 exist and are operated in series, consideration will be given to operation in parallel if sufficient excess capacity exists.
 - Treatment units may be added to increase, for example, contact time if that were the issue.
 - Existing treatment units may be removed and replaced with upgraded
 equipment, if appropriate (e.g., replace equalization tank with a larger tank).

2.6 PHASE 1B CULTURAL RESOURCES SURVEY

The Phase 1B cultural resources survey will assess the presence or absence of cultural resources (historic structures and archaeological sites) in and near the study area using documentary research, site inspection, and an archaeological field-testing program. The location of each documented resource will be evaluated, and a preliminary recommendation about the potential eligibility (significance) of each resource to the State and National Registers of Historic Places will be developed.

The Phase 1A cultural resources survey found that the majority of Lot 1A has a moderate to high probability to contain prehistoric archaeological resources, whereas Lot 1B does not (highly disturbed from previous activity at the site). Therefore, the approach to the Phase 1B effort is to test those portions of Lot 1A that will be physically impacted by the remediation efforts (excluding locations that have been previously disturbed). Based on the findings of the Phase IA report and an in-field assessment performed by an archaeologist on February 8, 2001 the chief area of effort will be the undisturbed ground adjacent to the northeast corner of the fence separating Lots 1A and 1B where excavation is anticipated, as shown on Figure 2-8. This location is estimated to cover approximately 50,000 square feet. As the design proceeds, additional areas of the site may require assessment as well (e.g., for access roads beyond the excavation limits). The same approach will be applied to these areas.

Fieldwork will begin with a systematic surface reconnaissance, and will be followed by testing as described in Section 3.11. The study will integrate the cultural resources sensitivities with other environmental constraints (wetlands, buffers, disturbance, 500-year floodplain, watercourses) and engineering plans. Details of the survey are provided in Section 3.11.

2.57 DELIVERABLES

In accordance with the SOW (Section VII), the remedial design for both Remedial Work Elements I (soils) and II (groundwater) will be completed using a two part sequence; (1) a preliminary design report and (2) a final design report. The approach to preparing these deliverables has been designed to present the information so that decision making will occur at the preliminary design stage, and final design will be used to complete details. More specifically, as discussed in more detail in Section 4.1, the preliminary design reports will contain both the results of the pre-design investigation as well as the conceptual design for the remedial work elements. This information will permit a review of the PDI data in conjunction with the preliminary design and agreement on the design approach prior to

completing the design details. The final design reports will then detail the design as well as add a number of ancillary items such as the Construction Quality Assurance Plan, Long-term Monitoring Plan, etc., as is described in more detail in Section 4.2.

Based on the foregoing, the project deliverables may then be summarized as follows:

- Preliminary design reports that include the results of the pre-design investigation (separate soils and groundwater, but including the pre-design verification study for the groundwater extraction system), basis of design, preliminary engineering drawings, a specifications outline, and a preliminary construction schedule.
- Final design reports that contain finalized information from the preliminary design reports as well as final engineering drawings, technical specifications, a construction quality assurance project plan, a wetlands mitigation plan, a construction schedule, and a cost estimate. In addition, as a part of the final design report for groundwater, a long-term groundwater monitoring plan will be developed. This plan will likely include the periodic monitoring of a selected number of wells at the site. The plan would define the monitoring network and frequency, as well as the protocols for sampling, analysis and reporting. Similarly, the monitoring program would also include surface water and sediment monitoring, as applicable. The applicability and extent of a surface water and sediment monitoring program will be dependent upon the completed remedial action, as is discussed further in Section 3.2.

3.0 PRE-DESIGN INVESTIGATION (PDI) SCOPE

A Pre-Design Investigation (PDI) as discussed in Section 2.0 is described in the following sections. Additional details regarding the field methods are presented in the Sampling, Analysis, and Monitoring Plan (SAMP) in Appendix A. The laboratory procedures will follow current SW-846 methodology as described in the Quality Assurance Project Plan (QAPP) in Appendix B. A Health and Safety Contingency Plan (HASCP) to be followed for field activities is presented in Appendix C.

Access to the site will be granted by the Chemsol PRP Group. Access to off site properties will be obtained by the Attorneys for the PRP Group prior to implementing the work. Should reasonable attempts to obtain access to off site properties fail, USEPA assistance may be required to secure access for the Chemsol PRP Group. Water generated during the various activities of the PDVS will be pumped to the on-site groundwater treatment plant for treatment and disposal.

3.1 SOIL DELINEATION

As described earlier in Section 2.1, the objective of the soil delineation program is to define the horizontal extent of PCB and lead concentrations above 1 and 400 ppm, respectively. To address this objective, soil samples will be collected using a two-inch diameter split spoon driven through the 0-2-foot interval. These locations will be completed at approximately 50-foot intervals as needed to define the horizontal extent of soils containing concentrations in excess of 1 ppm PCBs and 400 ppm lead.

The proposed sampling locations (58 locations), and their relationship to the area previously defined in the RI as requiring excavation, are illustrated on Figure 3-1. The rationale for the sampling locations was previously discussed in Section 2.1. Anticipated sampling parameters at each location, based upon existing information within that area, are summarized in Table 3-1. Each of the sampling locations will be located and staked in the field by a

TABLE 3-1

TYPE OF ANALYTICAL SAMPLES TO BE
COLLECTED AT SOIL BORING LOCATIONS

	Analytical Parameters				
Boring No.	Lead	PCB	VOCs	TCLI	
SB-88		X			
SB-89		\mathbf{X}			
SB-90		\mathbf{X}			
SB-91		\mathbf{X}			
SB-92		X			
SB-93		X			
SB-94		\mathbf{X}			
SB-95		\mathbf{X}			
SB-96		\mathbf{X}			
SB-97		\mathbf{X}			
SB-98		${f x}$			
SB-99		\mathbf{X}			
SB-100		\mathbf{X}			
SB-101	•	\mathbf{X}			
SB-102		\mathbf{X}			
SB-103		X			
SB-104		X			
SB-105		X			
SB-106		\mathbf{X}_{-}			
SB-107		X			
SB-108		X			
SB-109		\mathbf{X}			
SB-110		X			
SB-111		X			
SB-112		X			
SB-113		X			
SB-114		X			
SB-115	X	X			
SB-116	X	X			
SB-117		X			
SB-118		X			
SB-119		X			
SB-120		X			
SB-121	X	X			

TABLE 3-1

TYPE OF ANALYTICAL SAMPLES TO BE
COLLECTED AT SOIL BORING LOCATIONS

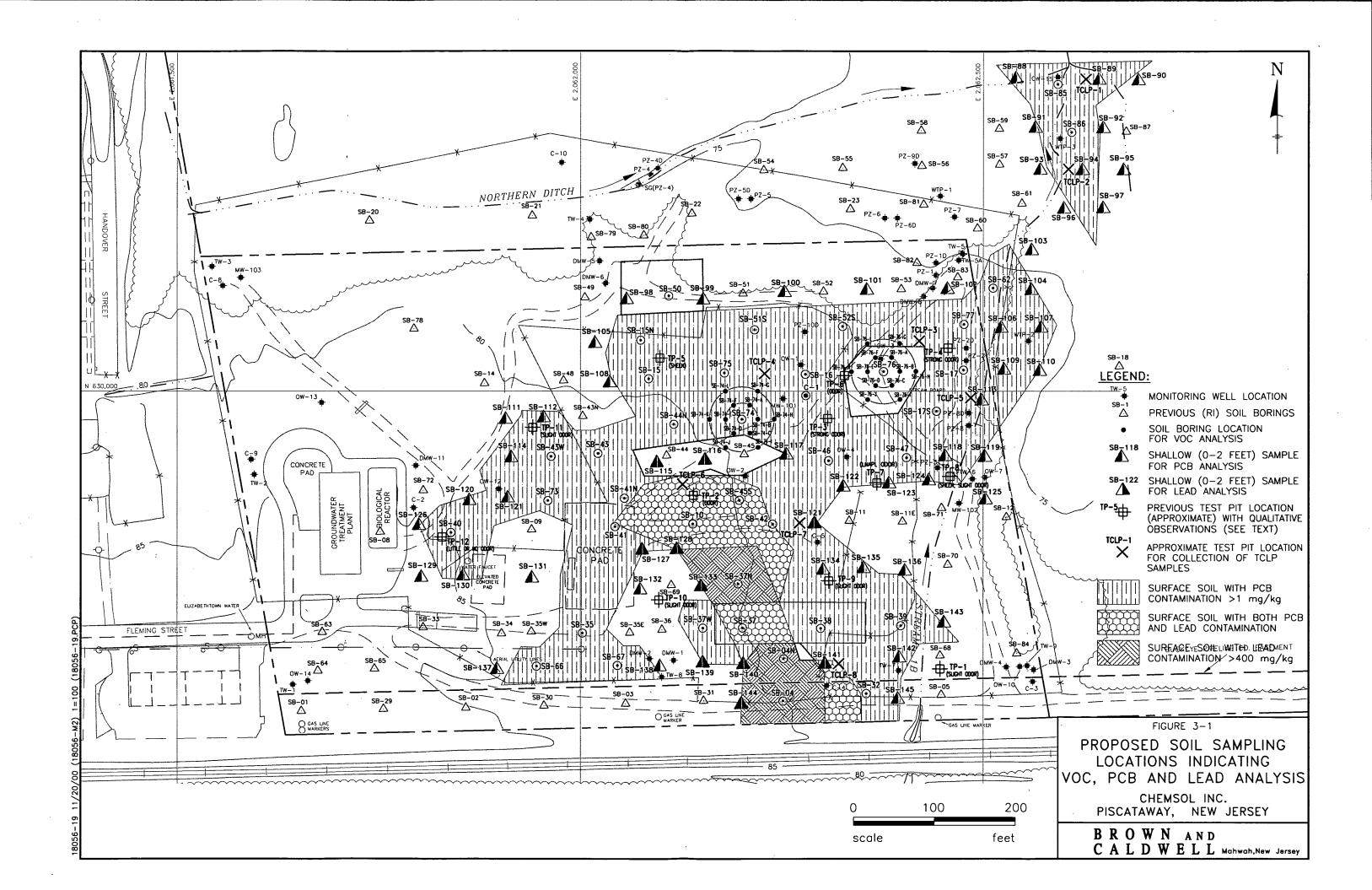
	Analytical Parameters					
Boring No.	Lead	PCB	VOCs	TCL		
SB-122		х				
SB-123		\mathbf{X}				
SB-124		X				
SB-125		\mathbf{X}				
SB-126		X				
SB-127	\mathbf{X}_{i}	X				
SB-128	X	X				
SB-129		X				
SB-130	•	X				
SB-131		X				
SB-132		X				
SB-133	\mathbf{X}	X				
SB-134		\mathbf{X}				
SB-135		X				
SB-136		X				
SB-137		X				
SB-138		X				
SB-139	\mathbf{X}	X				
SB-140	X	\mathbf{X}				
SB-141	X	X				
SB-142		X				
SB-143		X				
SB-144	\mathbf{X}	X				
SB-145		X				
SB-76-A through SB	-76-L		X			
SB-74-A through SB	-74-L		X			
TCLP-1				X		
TCLP-2				X		
TCLP-3				X		
TCLP-4				X		
TCLP-5				X		
TCLP-6				X		
TCLP-7				X		

TABLE 3-1

TYPE OF ANALYTICAL SAMPLES TO BE
COLLECTED AT SOIL BORING LOCATIONS

Boring No.	Analytical Parameters				
	Lead	PCB	VOCs	TCLP	
TCLP-8				x	
TOTALS	10	58	24*	8	

^{*} The total number of VOC analyses will be dependant upon the results of preceding samples collected around previous borings 74 and 76.

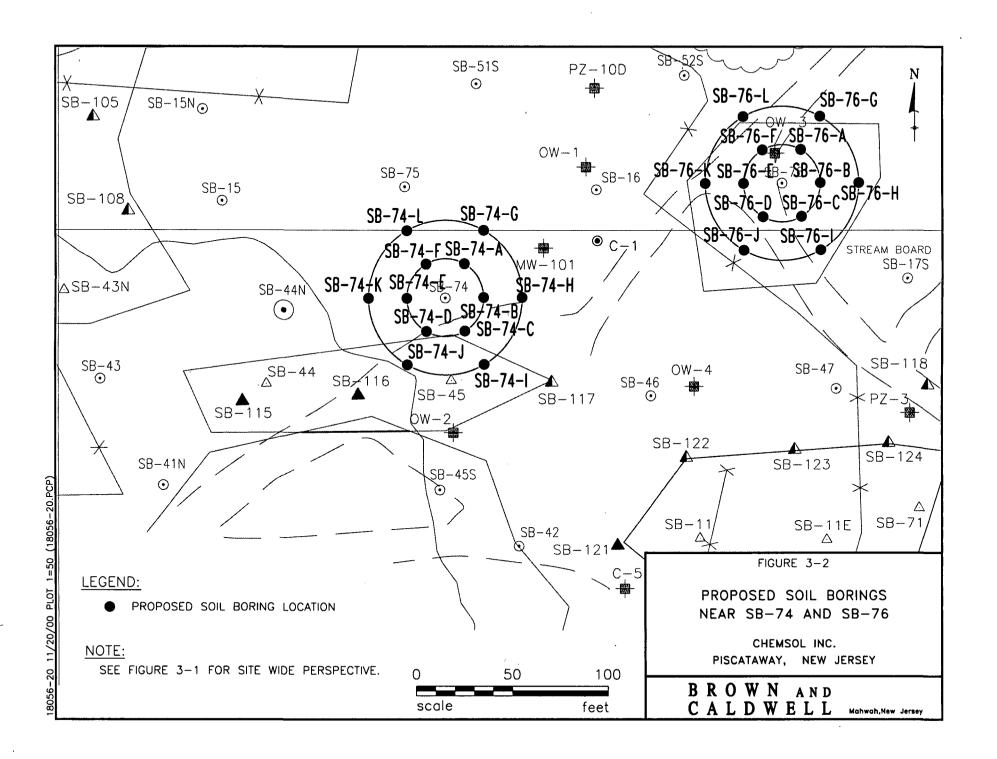


licensed New Jersey surveyor prior to implementation of the work. In this manner, the existing soil boring sample locations may be accurately located and the delineation sampling called for in the RDWP can be conducted at the desired locations.

At each location, the split spoon will be driven to a depth of two feet. Upon opening the split-spoon, the sample will be screened with the PID as described in the SAMP and, for sampling conducted adjacent to Soil Borings 74 and 76, a sample will be collected for VOC analysis from the interval registering the highest PID reading. The sample will then be visually described for grain size followed by homogenization of the sample (in accordance with the NJDEP field sampling guidance using a stainless steel bowl) from which aliquots will be collected for the analysis of PCBs, lead, and/or TCLP, depending upon the location and objective for each location and as summarized in Table 3-1.

In the event that the horizontal extent of soils requiring excavation is not defined by the sampling program (PCBs < 1 ppm, Lead < 400 ppm) proposed herein, additional samples will be collected at appropriate field determined intervals not greater than approximately 50 feet, as needed to provide adequate delineation. Although vertical sampling is not required, the respondents have agreed to perform sampling, for the purpose of a deed restriction, on an approximate 50 foot grid within the bottom of the excavation. Sampling for the purpose of a deed restriction will be discussed in the remedial design documents.

Additional delineation sampling will also be conducted in the vicinity of existing boring locations 74 and 76 (see Figure 3-2). Twelve borings will be advanced around each of these locations at radii of 20 and 40 feet (six borings at each radius) from the original location as illustrated in Figure 3-1. Provided competent rock is not present (i.e., the boring can be advanced with hollow stem augers and samples collected with a split spoon), samples will be collected at depths of 0 - 2 feet and 4 - 6 feet at each location. The samples will be screened with the PID and a sample collected for VOC analysis as described above. These data will be used to determine the extent of excavation required in this area, up to a maximum of a 50-foot radius.



In the event that competent rock is encountered at depths shallower than 4-6 feet, defined by split spoon refusal of 100 blows/six inches, the sample collected immediately above the competent rock will be collected for VOC analysis. The depth of the excavation within this area will then be limited by the analytical data or depth to competent rock as applicable.

3.1.1 Test Pit Program

In addition to the soil sampling program discussed above, a limited test pit program will also be conducted to evaluate both groundwater conditions and potential odors associated with excavation to a depth of two feet. Five to ten locations will be selected at various locations across the site (see Figure 3-1), favoring locations where odors were prevalent in the previously completed test pits. The soils will be excavated to a depth of two feet over an approximate 10 x 10 foot area. Specific observations will be made with respect to soil types, the location (bottom or sides of pit) and estimated volume of groundwater infiltration into the pit (i.e., using the pit dimensions and measured water level rise), odors, etc. In addition, samples will be collected of the excavated material for TCLP testing to provide information on future disposal options. Upon completion, each test pit will be backfilled with the excavated material and staked for reference.

3.2 CHARACTERIZATION OF SURFACE WATER AND SEDIMENT QUALITY

As called for in the SOW (Section III), characterization of surface water and sediment quality will be conducted to determine if the remediation of Lot 1B results in lower contaminant concentrations in surface water and sediment over time. To this end, one round of samples from surface water and sediment will be collected from the locations as illustrated on Figure 3-3. These include two sample locations, along the north ditch, Stream 1A, and Stream 1B for a total of six samples. The objective of these samples is to provide a characterization of the surface water and sediment quality prior to conducting remedial activities. The samples will be collected as surficial grabs in accordance with the methods described in the SAMP. Each of the collected samples will be analyzed for PCBs, lead, and volatile organics in accordance with the QAPP. The need for additional surface water and sediment monitoring will be evaluated during the remedial design and will be

based upon the conditions that will exist after implementation of the remedy. For example, if the selected remedy calls for the removal of soil/sediment from Stream 1B or relocation of the stream channel around the impacted area, the proposed monitoring program would be different than a scenario in which the area remained untouched.

3.3 HYDROLOGIC AND WATER QUALITY DATA COLLECTION (SOUTHERN OFF-SITE PROPERTY)

As required in the SOW (Section III), hydrologic and water quality data will be collected from three (3) off-site wells located to the south (wells TW-14, TW-15, and MW-104). As previously discussed in Section 2.3, the objective of these data collection efforts is to demonstrate the direction of groundwater flow and assist in determining whether contaminated groundwater is leaving the property boundaries to the south. Potential off-site groundwater pumping influences that may affect groundwater flow in this area will also be evaluated as applicable. This may include locating off-site pumping wells and obtaining additional data with respect to depth, pumping rate, frequency of use, etc. The specific work elements to be conducted are presented below in Sections 3.3.1 through 3.3.3.

3.3.1 Locate Well MW-104

Records contained within the RI indicate the presence of an off-site well, identified as MW-104, located south of the Chemsol property and screened within the Deep Bedrock unit. This well is believed to have been disturbed by recent construction of a supermarket and has not been found during recent site visits. It is suspected that the well may still exist, but has been covered either with pavement and/or soil. An effort will be made to locate existing off-site well MW-104 by re-establishing existing survey data and using a metal detector to locate the surface casing. If the well can be located, it will be uncovered and its condition assessed. Further use of the location will be dependent upon its integrity. Given the upgradient location and screened interval of MW-104 (Deep Bedrock Unit), the potential value of data collected from this location is limited (i.e., data collected from this location would not be critical with respect to understanding site conditions, on-site zone of capture, etc. and two other wells are available off-site in this area for the work to be performed in

assessing groundwater conditions to the south). Therefore, we do not recommend a replacement of this well if it cannot be found or if its integrity would compromise its use. The above-described work will be dependent upon obtaining permission for off-site access.

3.3.2 Groundwater Quality Sampling

Groundwater quality samples will be collected from each of the southerly, off-site wells (TW-14, TW-15, and MW-104) to assess whether contaminated groundwater is leaving the site to the south, as previously discussed in Section 3.3 above. The samples will be collected using conventional purging methods, as described in the SAMP. The samples for metals analysis will not be field filtered and will be expressed as "total". However, in the event that the turbidity of the sample is greater than 50 NTUs, an additional field filtered sample will also be collected for "dissolved" metals analysis. The samples will be tested for the TCL organic constituents and TAL inorganics in accordance with the QAPP.

3.3.3 Long-Term Water Level Monitoring

As described in Section 2.3, long-term water level monitoring will be conducted to assess potential changes in groundwater flow directions associated with seasonal changes or off-site influences, south of the Chemsol property. This will be accomplished by installing down-hole, water level data loggers (In-situ, Inc., Troll®) in existing monitoring wells located on the southern side of the site (tentative selections are wells C-3, C-4, TW-7, TW-14, and TW-15) for an extended period of time (approximately 6 months). The loggers will be set to provide water level measurements at pre-specified, uniform time increments (e.g., 15-minute intervals) for the test duration.

Precipitation data for the test period will also be obtained from a nearby weather recording station. Likewise, data from the on-site pumping of well C-1 will also be maintained for later comparison to the collected water level data. These data will be used in conjunction with static water level data, described in Section 3.6, to evaluate groundwater flow directions and potential changes related to off-site influences.

This task is proposed as part of the RDWP and is not intended to address the long term water level monitoring that will be completed as part of the remedial design. A long term water level monitoring program will be proposed and implemented as part of the remedy.

3.4 GROUNDWATER TREATMENT PLANT EVALUATION

In developing the final remedy, it is possible that influent groundwater quality characteristics and/or flow rate may change by comparison to current conditions. To this end, the groundwater treatment plant will be evaluated to assess its practical capacity for treating extracted groundwater from the site. The following items will be addressed in this evaluation:

- Flow and concentration characteristics of the anticipated influent based upon data
 obtained during the PDI and how these data may impact or change the current
 influent conditions. Flow and concentration data will be compiled and compared
 to effluent criteria and expected treatment equipment performance.
- Design capacity of the existing treatment processes, whether or not there is sufficient capacity, and whether the treatment processes are capable to treat the modified influent characteristics. This analysis will be based on both the hydraulic capacity and treatment capacity of the existing equipment.
- Whether or not additional treatability studies are required to assess whether sufficient treatment will occur with the addition of new wells.
- Evaluate potential modifications to permitting requirements. These may include
 modifying flow allocations in the water allocation (groundwater diversion) permit,
 groundwater treatment system discharge permit, treatment works approval permit,
 air permit (if additional VOC emissions result), and sludge disposal permit and
 NPDES permit, as applicable.

3.5 DRILLING AND WELL INSTALLATION

A drilling and well installation program will be implemented to install the wells that will be used as a part of the Pre-Design Verification Study (PDVS) and also for water quality and water level monitoring. The wells will include the following:

- Three new extraction wells, with wells in the:
 - Full thickness of the Upper Permeable Aquifer.
 - Full thickness of the Principal Aquifer.
 - Upper 50 feet into the Deep Bedrock Unit.
- One monitoring well triplet, with individual wells installed in the Upper Permeable
 Aquifer, Principal Aquifer, and the Deep Bedrock Unit.
- One Deep Bedrock Unit monitoring well.

The extraction and monitoring well locations are illustrated in Figure 3-3 and a summary of the casing depth and approximate target interval for each location is presented in Table 3-2. The location and water-bearing unit targeted by each extraction or monitoring well is based upon groundwater capture simulations performed using a numerical groundwater flow model, as described in Section 2.2.2. The zone of capture produced by pumping the new extraction wells will be evaluated using both new and existing monitoring wells located across the site.

Designing the extraction wells in the Principal Aquifer with an open interval across the full thickness is based upon the water level data, which indicates that there is only a nominal (a couple of tenths of a foot) head loss from the top to the bottom of this water-bearing zone, and also that the objective of the system is to contain groundwater within the site boundaries and remove mass as practicable. This is supported by the relatively consistent head throughout the water-bearing zone which indicates that there is good hydraulic connection

TABLE 3-2
TARGET DEPTHS OF PROPOSED WELLS
Chemsol Inc. Superfund Site

Well No.	Hydrostratigraphic Zone	Approx. G.S. Elevation (ft. NGVD)	Approx. Thickness of Target Interval* (ft)	Approx. Bottom Elevation (ft. NGVD)	Approx. Bottom Depth (ft)	Approx. Casing Depth (ft)
Extraction Wells				-		
EX-2-UP	Upper Permeable Aquifer	73	40	-25	98	. 60
EX-1-P	Principal Aquifer	75	190	-225	300	110
EX-3L	Deep Bedrock Unit	77	50**	-390	470	420
Monitoring Wells						
MW-201-UP	Upper Permeable Aquifer	80	40	-60	140	120
MW-201-P	Principal Aquifer	80	190	-200	280	190
MW-201-L	Deep Bedrock Unit	80	50**	-370	450	190
MW-202-L	Deep Bedrock Unit	73	50**	-300	370	120

^{*} Estimated thickness of the Hydrostratigraphic Zone at the proposed well location. Extraction wells will target the full thickness. The monitoring wells with target a ten foot interval near the center of the Upper Permeable and Principal Aquifers having the greatest permeability as measured by packer testing. The monitoring wells in the Deep Bedrock will target the interval with the greatest permeability in the upper thirty feet of this zone.

^{**} Total thickness of this unit is unknown. The upper 30 to 50 feet will be targeted for this investigation.

from top to bottom within the Principal Aquifer (i.e., the fracture network is interconnected from top to bottom). Therefore, any given change in head due to pumping will be transmitted throughout the full thickness of the unit. This approach may negate the need to have multiple wells at different depths and makes the use of a single well most effective.

The single well approach is also consistent with the objectives for groundwater capture and associated mass removal, in the presence of highly contaminated zones. By completing the well across the full thickness of the unit, fractures of high hydraulic conductivity and fractures which may exhibit lower hydraulic conductivity but higher contaminant concentrations will all be captured. Completing the well across fractures with high hydraulic conductivity will transmit the pumping stress across the site and facilitate groundwater capture. At the same time, fractures of lower hydraulic conductivity, some of which may have higher contaminant concentrations, will be within the zone of capture and therefore, mass removal will also be accomplished.

Notwithstanding the foregoing, the PDVS is designed to demonstrate through *empirical* data that groundwater containment will be achieved for a given pumping rate, extraction well construction (i.e., length of open interval), and extraction well layout (locations and depths). Therefore, in the event that containment is not achieved with the initial well layout and the construction configuration (e.g., open interval) presented as the starting point for the PDVS, additional efforts will be undertaken. These additional efforts may include increased pumping rates or new well locations.

The narrative that follows describes first, the configuration and construction of the extraction wells and second, the configuration and construction of monitoring wells to be installed as part of the PDVS.

3.5.1 Extraction Wells

The three bedrock extraction wells will be constructed as eight-inch (8") nominal diameter, open-rock boreholes with eight-inch (8") carbon steel casing. The casing will be tremie-grouted into a 12-inch diameter borehole.

The drilling of each extraction well will commence by advancing a pilot borehole (3 – 8 inch diameter) to the anticipated depth of the well casing, based upon available information from existing borehole data. Downhole geophysics (caliper, gamma, spontaneous potential (SP) and temperature) and pressure-packer testing, as described in Sections 5.2.4 and 5.2.5 of the SAMP (Appendix A), will be used to identify bedrock stratigraphy and fracture zones. The borehole will then be reamed to a 12-inch (12") diameter for the installation of the 8-inch casing, the depth of which will be determined from the aforementioned borehole testing. An eight-inch diameter borehole will then be advanced to the total depth of the well to serve as the well intake. Target casing depths and total depth of each well are presented in Table 3-2. Upon completion, each new extraction well will be developed to remove fine-grained materials generated during the drilling process and facilitate hydraulic communication with the surrounding water-bearing zone. The methods to be employed for the extraction well installation and development are described in the SAMP.

3.5.2 Monitoring Wells

Monitoring wells will be constructed with two-inch (2") diameter, flush-joint PVC equipped with a ten-foot (10") slotted PVC well screen. PVC well casing and screen has been selected because the proposed monitoring wells are located near the perimeter of the site where the concentrations of volatile organics are not high enough for concern relative to potential interactions with PVC (e.g., damage from solvents).

Each well will be installed in a borehole equipped with six-inch (6") diameter, steel secondary casing that is set in a ten-inch (10") diameter borehole at depths described in the section that follows. The secondary casing is intended to limit the vertical migration between the shallow aquifer and deeper, less-impacted aquifers within the borehole. The secondary casing will be set prior to advancing the boreholes into the lower aquifer(s). Upon completion, each of the new monitoring wells will be developed to remove fine-grained materials generated during the drilling process and facilitate hydraulic communication with the surrounding water-bearing zone. The monitoring wells will be

constructed and developed following the methods as described in the SAMP. Other monitoring well construction details specific to each zone are described in the following sections.

Deep Bedrock Unit

Monitoring wells in the Deep Bedrock Unit (MW-201L and MW-202L as illustrated in Figure 3-3) will be constructed by advancing a ten-inch (10") borehole to the anticipated depth of the bottom of the Upper Gray Shale (top of the Principal Aquifer). The location and presence of the Upper Gray Shale will be determined by packer testing and geophysically logging the borehole. A six-inch diameter steel casing, through which the remaining drilling will be completed, will then be set and tremie grouted at or near the bottom of the Upper Gray Shale. After allowing the grout to set for approximately 24 hours, a six-inch (6") diameter borehole will be advanced to a depth of approximately 30 feet below the estimated depth of the deep gray shale. The full length of the open borehole will then be geophysically logged and packer testing will be conducted at ten-foot intervals within the lower 60 feet of the borehole at location MW-202 (data for the upper 60 feet are available from existing adjacent locations) and through the full length of the open borehole at location MW-201. These data will then be used to determine the stratigraphy of the surrounding rock and the screened interval of the installed monitoring well.

The Deep Bedrock Unit monitoring wells will be installed at the ten-foot interval having the greatest permeability as measured by the packer tests. In the event that this interval is above the bottom of the borehole, the borehole will be backfilled by tremie grouting. The volume of the borehole to be backfilled will be calculated and this volume of grout will be tremied to the bottom of the borehole and allowed to set for six hours. The depth of the borehole will then be checked and remaining volume will be filled with bentonite pellets. Bentonite pellets will also be placed using a tremie pipe and potable water to prevent them from hanging up on the sides of the borehole before reaching the intended depth.

The installation of a steel casing to the deep gray shale has not been proposed for several reasons. First, there is currently no indication that there are DNAPLs present along the back

property line where these wells will be installed. The constituent with the highest concentration at DMW-9, for example, is 1,2-dichloroethene (total) at 1400 ppb. (November 1998 data). The solubility of cis-1,2-dichloroethene is 800,000 ppb and trans 1,2-dichloroethene is 600,000 ppb. Applying a worst case assumption that the 1400 ppb is all trans, and using the rule of thumb that concentrations over 1% of the solubility limit suggest the possibility of DNAPL, the concentration in DMW-9 is well below the 1% criterion of 6,000 ppb. (1% of 600,000).

In addition to the above, there is currently an existing location closer to the suspected source area (well DMW-6) that bridges the deep gray shale and forms a continuing conduit between the lower principal aquifer and the Deep Bedrock. The water quality data also indicates that the Deep Bedrock contains TVO concentrations as high as 1500 ppb (DMW-8, Nov. 1998).

Irrespective of the above, however, additional efforts will be made during the drilling program to limit the amount of time the borehole is open and to remove additional volumes of water during development of the newly completed well. In this manner, potential organic compounds that may be introduced to the deep bedrock during the limited time associated with well construction, can be removed.

Additional procedures to be employed during the drilling will include timing of the drilling with the work day. For example, if nearing the end of the day, the drilling will stop above the deep gray shale and will be completed the following day. Similarly, upon reaching the total depth (approximately 30 feet below the deep gray shale), pulling of the drilling rods and packer testing will proceed based upon the time of day. If within several hours of the end of the day, the double packer assembly will be installed to total depth and the packers will be inflated just above the deep gray shale and left in this position over-night. Packer testing will resume in the morning. Conversely, if there are sufficient work hours left in the day, packer testing will begin from the top down in ten foot intervals so that by the end of the day the packers are near the bottom and can be left inflated over-night. The above procedures will be implemented to limit the amount of time that the borehole is open below the deep gray shale.

Similarly, development of the well will be implemented as soon as possible (allowing sufficient time for the annular grout seal to set-up). The development process will initially focus on extracting groundwater from the well as opposed to surging. Depending on the productivity of the well, the well would be pumped at a continuous rate for one to two hours with the objective of purging the well and surrounding water-bearing zone of water that may have been introduced from above during drilling.

Principal Aquifer

Monitoring wells will be installed in the Principal Aquifer at triplet location MW-201 by moving approximately 5 to 10 feet laterally from the Lower Bedrock Monitoring well. Each well will be constructed by advancing a ten-inch (10") borehole to the anticipated depth of the bottom of the Upper Gray Shale (top of the Principal Aquifer). A six-inch diameter steel casing will then be tremie grouted in place through which the remaining drilling will be completed. After allowing the grout to set for approximately 24 hours, a six inch borehole will be advanced to the depth near the approximate midpoint of the Principal Aquifer having the greatest permeability as measured by the packer testing completed in the adjacent borehole (Deep Bedrock well) described above.

Upper Permeable Aquifer

Monitoring wells will be installed in the Upper Permeable Aquifer at triplet location MW-201 by moving approximately 5 to 10 feet laterally from the Lower Bedrock or Principal Aquifer monitoring well. A six-inch (6") diameter steel casing will be installed within a ten-inch diameter (10") borehole advanced to a point approximately five to ten feet (5 - 10") feet above the top of the Upper Permeable zone as defined by the packer testing conducted in the adjacent Principal Aquifer borehole. A six-inch (6") diameter borehole will then be continued through the Upper Permeable zone within which a two-inch (2") monitoring well will be installed.

TABLE 3-3
WELLS TO BE MONITORED DURING PDVS

					_		
Wells to	he	monitored	2	minimi	nt.	Once	dadia
W CHO IO	UC	momorca	а	TITTITITITITITI	\sim	Olive	mun,

C-1	DMW-1	TW-1	MW-101
C-2	DMW-2	TW-2	MW-102
C-3	DMW-3	TW-3	MW-103
C-4	DMW-4	TW-4	MW-201UI
C-5	DMW-5	TW-5	MW-201P*
C-6*	DMW-6	TW-5A	MW-201L*
C-7*	DMW-7	TW-6	MW-202L*
C-8	DMW-8	TW-7	
C-9	DMW-9*	TW-8	
C-10	DMW-10*	TW-9	
•	DMW-11	TW-10	
		TW-11	
		TW-12	
		TW-13	
		TW-14	
		TW-15	

^{*} Well equipped with automatic data logger

Wells to be monitored at start-up and prior to change in pumping rate

OW-1	PZ-1	SG-PZ-4
OW-2	PZ-1D	SG-PZ-8
OW-4	PZ-2	
OW-10	PZ-2D	
OW-11	PZ-3	
OW-12	PZ-4	
OW-13	PZ-4D	
OW-14	PZ-5	
OW-15	PZ-5D	
	PZ-6	
	PZ-6D	
,	PZ-7	
	PZ-8	
	PZ-8D	
	PZ-9D	
	PZ-10D	

3.6 WATER LEVEL MEASUREMENTS

3.6.1 Static Water Level Measurement

A site-wide round of static water level measurements will be made from each of the site wells. This is intended to provide an updated evaluation of groundwater flow conditions across the site, prior to conducting the PDVS and will provide a supplement to the last round of non-pumping data which was obtained on July 20, 1999.

Data loggers will be installed in wells C-1, C-5, C-6, C-10, DMW-9, TW-5, and MW-101, and MW-201UP, after which the existing recovery well, C-1, will be shut down. These locations represent wells closest to C-1 and the data loggers will be used to monitor the recovery of groundwater levels to static conditions (wells closest to the pumping well, C-1, will have the greatest drawdown and will thus require the longest time for recovery). Once static conditions are indicated, a round of water levels will be collected from the available monitoring points.

3.6.2 Antecedent Water Level Conditions

Immediately upon completion of the aforementioned static water level determinations, the data loggers will be re-located as necessary and set up in the following locations; MW-201UP, MW-201P, MW-201L, C-6, DMW-9, MW-202L, C-7, and DMW-10. These wells represent those closest to the pumping wells and include two clusters of three wells (wells in the Upper Permeable, Principal and Deep Bedrock), and one cluster of two wells (Upper Permeable and Principal) located along the back property line. These wells represent the most important wells for the collection of data during the pump tests and will therefore, also be monitored under the static conditions will continue to be monitored using the data loggers ffor a period of approximately five days prior to the PDVS. These data will be compared to meteorological data (i.e., precipitation and barometric pressure conditions) to document antecedent conditions. The meteorological data will be obtained from the NOAA recording station located in nearby New Brunswick, New Jersey.

3.7 PRE-DESIGN VERIFICATION STUDY

3.7.1 Groundwater Containment System

The PDVS will be conducted by progressively pumping each of the three (3) newly installed extraction wells while monitoring drawdown in the monitoring network that is comprised of the newly installed and existing monitoring wells (Table 3-3). The objective of this study is to assess the combined extraction rate needed to contain on-site groundwater through direct observation of aquifer response. The aquifer response will be monitored by collecting manual water level measurements and through the use of data loggers installed in the wells previously noted above (MW-201UP, MW-201P, MW-201L, C-6, DMW-9, MW-202L, C-7, and DMW-10C-1, C-5, C-10, TW-5, and MW-101) as well as wells C-6, DMW-9, and MW-202L. With the exception of the overburden wells noted in Table 3-3, manual water level measurements will be collected at a minimum frequency of once daily, prior to the increase in pumping rate or addition of a new pumping well, and immediately following an increase in pumping rate or addition of a new pumping well. Monitoring of the overburden wells will only be conducted at start-up and prior to a change in pumping rate as these wells will be slow to respond to pumping of the bedrock groundwater.

As described in Section 2.0, the locations and pumping rates of the newly installed extraction wells are based upon the results of previous groundwater flow modeling (Eckenfelder Inc., October, 1997). Using the pumping rates and drawdown as predicted by the model as a starting point, the PDVS will be conducted as follows:

• Well EX-1 (the replacement to well C-1) will be pumped at 11 gpm for a period of three days while observing drawdown in the monitoring well network. The 11 gpm flow rate represents approximately 75% of the pumping rate predicted by the model as being needed at this location to achieve capture. Water level measurements will be collected at a minimum frequency of once daily. Water generated during the PDVS will be pumped to the on-site groundwater treatment plant.

- After the initial step, the pumping rate of EX-1 will be increased to 100% of the
 predicted pumping rate (15 gpm) for an additional three-day period. Daily water
 level monitoring will be continued as previously described.
- At the conclusion of the second step, pumping of well EX-1 will be continued at a
 rate of 15 gpm while adding extraction well EX-2 at a pumping rate of 5 gpm, as
 predicted by the groundwater model, for an additional three-day period. Daily
 water level monitoring will be continued.
- Pumping of extraction wells EX-1 and EX-2 will be continued while adding extraction well EX-3 at a pumping rate of 5 gpm, as predicted by the groundwater model, for a three-day period. Daily water level monitoring will be continued.
- The pumping rates of one or more of the wells will be varied, as required, to meet the capture objectives, within the capacity limitations of the on-site groundwater treatment plant. In the event that the capture objectives cannot be met within the capacity limitations of the on-site groundwater treatment plant, the collected data will be evaluated to the extent possible and further recommendations will be made, as appropriate. This may include providing additional on-site storage, portable treatment units, etc. as needed to provide the capacity required to complete the test and demonstrate the desired zone of capture. Similarly, the observed response to pumping in the monitoring well network will be used to provide recommendations, if needed, for the installation of additional monitoring wells, either on or off site, for the purpose of demonstrating that the intended zone of capture is being attained. In the event that new wells are added, the aquifer response tests would be repeated as needed to demonstrate capture.
- Water quality samples will be collected at each of the three (3) extraction wells following the start of pumping at each location and immediately prior to shutting off the pumps (i.e., two samples from each pumping well). The samples will be

collected from an in-line sampling port and each of the samples will be analyzed for the TCL, TAL, and conventional parameters as described in the QAPP.

3.7.2 Evaluation of Wells TW-4 and TW-5

In addition to the PDVS elements described above, the potential to enhance mass removal was previously evaluated by independently pumping wells TW-4 and TW-5 at their sustainable yields for a period of approximately two weeks each. The water levels in the well were monitored with a data logger and three water quality samples were collected from each well following the start of pumping, at the approximate midpoint of the pumping period, and immediately prior to shutting off the pumps (i.e., three samples from each well collected over the duration of pumping from that well). Each of the samples were analyzed for TCL VOCs. The sustainable yields of the wells (<1 gpm) and the analytical data will be presented in the Design Report and used to calculate the contaminant mass removed during the test. These data may then be extrapolated to evaluate the potential to enhance mass removal through the pumping of shallow groundwater extraction wells. To date the data indicate based on the low yield of the wells and water quality consistent with other wells on the site, that mass removal from these wells will not be of significance.

3.8 SURVEY

Each of the newly installed wells and surface water/sediment sampling locations will be surveyed. In addition, a re-survey of each of the existing wells, piezometers, and stream gauges will also be performed. The survey will include location coordinates (referenced to the New Jersey State Plane grid) and ground surface elevation and top of casing elevation data (referenced to the NGVD of 1983). The survey will be performed by a New Jersey-licensed surveyor.

3.9 GROUNDWATER QUALITY CHARACTERIZATION

Groundwater quality samples will be collected from each of the newly installed monitoring wells, as described previously in Section 3.5.2. Each of the samples will be tested for the

TCL organics and the TAL inorganics. The sample collection and analytical methodologies are described in the SAMP and QAPP, respectively.

Collection and analysis of additional samples from existing monitoring wells, other than those described in Section 3.3.2 herein, are not proposed as a part of the PDI. Site-wide groundwater quality characterization was completed previously (November/December, 1998) and will be further addressed as a part of a Long-Term Monitoring Program (as described in Section 2.0), to be presented as part of the Remedial Design documents. The Long-Term Groundwater Monitoring Program will define the monitoring network, frequency of sampling, and the protocols for sampling, analysis and reporting.

3.10 EVALUATION OF POTENTIALLY LEAKING WATER LINE

A large diameter (48-inch) water main, owned and operated by the Elizabethtown Water Company, is located along the southern edge of the property. An evaluation may be conducted in order to determine if this water line is leaking and if this leaking may be impacting the local hydrogeologic conditions. Based on observations made during the PDI and PDVS (e.g., water levels, flow rates to extraction wells, flow rates into test pits), the potential for the water main to measurably impact groundwater extraction efforts at the site will be assessed. If this assessment indicates the potential for a significant impact, then the work described in the following sections will be undertaken. If this work is not planned, the USEPA will be notified in advance for confirmation.

Test Pits (Optional)

A series of test pits will be excavated in the vicinity of the water line. It is anticipated that permission can be obtained from the Elizabethtown Water Company to excavate immediately adjacent to the pipe at three to five locations to a depth that corresponds to the bottom of the pipe. In the event that permission cannot be secured to dig next to the pipe, the test pits will be excavated at the northern edge of the utility easement. Observations will be made regarding any apparent water seepage from the soil backfill that surrounds the pipe.

Piezometers (Optional)

Two (2) piezometer transects may be installed if the test pit data reveal the presence of water in the pipe backfill that may be indicative of a leaking pipe. The transects would extend perpendicular from the pipeline in a northerly direction and would each consist of three (3) shallow piezometers. The approximate horizontal spacing of the piezometers will be approximately 50 feet with the southern-most piezometers being located as close to the water line as is possible. The piezometers would be constructed of two-inch diameter PVC and would be installed at a depth that corresponds to the upper five feet (5") of saturated soil or weathered bedrock, as applicable. The objective of these transects would be to determine if a hydraulic gradient exists from the pipeline towards the site.

Water Quality Data

Water quality samples will be collected from the test pits (as grab samples) and/or the optional piezometers (through the use of a peristaltic pump). In addition, a sample will be obtained from a water tap in the treatment building which comes directly off the water main. Each of the samples will be tested in the laboratory for inorganic major ions. In addition, field tests will be conducted including residual chlorine (Hach CN-66), pH, DO, temperature, and specific conductivity. The data will be evaluated in order to assess the similarity of groundwater to that in the pipe, which may allow the determination of whether or not the pipe is leaking. Note that the potential presence of residual chlorine may require special sample preservation and/or analytical requirements as descried in the QAPP (Appendix B).

3.11 PHASE 1B CULTURAL RESOURCE STUDY

A Phase 1B Cultural Resources investigation will be conducted in accordance with Section 106 of the National Historic Preservation Act. The purpose of the study will be to provide a field confirmation of the absence of historic and/or pre-historic cultural resources, as described by the Phase 1A investigation conducted as part of the RI. The study will <u>be</u>

conducted using the approach described in Section 2.6. More specifically, the scope of this effort will be as follows:

evaluation that may include shovel tests, shallow hand auger borings and the excavation of shallow test pits. The scope of the Phase 1B study will be guided by the findings and recommendations presented in the Phase IA report. A copy of the Phase IA Report has been requested from USEPA and additional details regarding the Phase 1B study will be provided to USEPA, as applicable, following receipt and review of the Phase 1A Report.

• Background & Historical Research:

- Gather and review historical documentation and historic maps.
- Interview knowledgeable local persons
- Review relevant environmental and soils data.
- Visit various repositories to collect information on the historic and prehistoric background of the study area (Local Historical Society, Local Libraries, State Historic Preservation Office, Local Landmarks Commission, NJ State Museum, University Libraries)
- Site inspection by Senior Archaeologist to review site conditions and assess the area in preparation for the subsurface testing.
- Subsurface Testing Program (STP):
 - Standard 25-50-foot interval grid testing (shovel tests) in designated study area
 (the state standard is 17 tests per acre).

- Advance shovel tests using a four-inch diameter bucket auger.
- Use judgmental tests surrounding tests yielding cultural materials.
- Screen soils through 1/4-inch mesh hardware cloth.
- Record soil profiles from each test and label artifact bags for laboratory analysis.

Data gathered in the previous steps will be analyzed and interpreted in a report. The report will be completed to NJDEP-Historic Preservation Office (HPO) standards. The report will be generally organized as follows:

- Abstract
- Introduction
- Project Location Maps
- Project Description
- Environment
- Background Research
- Field Methods
- Analysis
- Resource Evaluation and Conclusions
- Photographs
- References

4.0 REMEDIAL DESIGN ACTIVITIES

The remedial design activities include the design of the excavation and off-site disposal of

soil materials and backfilling of excavations (Remedial Work Element I); installation of

additional wells or retrofitting existing wells and continued extraction and treatment of

groundwater; and long-term O&M of the remedy (Remedial Work Element II). The specific

activities of the remedial design are consistent with the ROD dated September 1998 and the

SOW.

In accordance with the SOW, the design will be prepared and submitted in two stages. The

initial stage will be prepared to obtain agency concurrence on the design basis. This stage

will achieve a conceptual design and will be documented in two Preliminary RD Reports

addressing Remedial Work Elements (RWE) I and II. The final stage of the design will be

presented in Final RD Reports covering RWE I and II, respectively. The design reports will

include plans and specifications, to the extent applicable at that stage of the design. The

Preliminary and Final RD Reports will be submitted to the agency for review. Comments

received on the Preliminary RD Reports will be incorporated, as appropriate, into the Final

RD Reports.

The design reports will be prepared pursuant to the SOW. The Preliminary and Final RD

Reports are discussed in more detail in the following two subsections.

4.1 PRELIMINARY REMEDIAL DESIGN REPORTS

The Preliminary RD Reports will present the relevant design information for the proposed

soil excavation, groundwater extraction system, groundwater treatment system (GWTS), and

the discharge system, as well as other relevant engineering work. The reports will include

preliminary engineering drawings and an outline (or table of contents) for the specifications.

The preliminary design submittal is described in further detail below.

4-1

4.1.1 Engineering Reports

Each of the engineering reports (i.e., for RWE I & II) will be prepared, as a part of the preliminary design, summarizing the results of design development and pre-RD activities associated with each RWE.

More specifically related to the pre-design investigation efforts, the preliminary engineering reports will contain the following:

- An evaluation of the groundwater data and nature and extent of contamination in each the hydrostratigraphic units:
- The findings of the PDVS including the pumping test results along with analysis that illustrates the basis for the groundwater extraction system (e.g., analysis of head data that shows the limit of capture).

The engineering report for each RWE will also provide a discussion of the design basis including:

- Excavation of surface soils containing PCBs or lead above the specified cleanup criteria (RWE I);
- Classification of excavated materials and disposal at appropriate off-site facilities;
 (RWE I)
- Selection and placement of clean backfill, followed by topsoil and re-vegetation of the surface (RWE I);
- Placement of new extraction wells and the operation of existing and new wells to achieve control/capture of impacted groundwater (RWE II);

- Groundwater treatment at the existing facility including a discussion of the
 practical capacity of the existing treatment system and measures for modifying the
 system (with supporting design computations), as appropriate based on the results
 of the PDVS for a (with additional treatment, if necessary), and discharge to the
 MCUA system (RWE II) or surface water;
- Prediction of the anticipated performance of the groundwater extraction system(RWE II);
- Preliminary plans for long term groundwater quality and water level monitoring to evaluate the effectiveness of the remedy with respect to groundwater capture and water quality (RWE II); and
- Plans for monitoring sediments and surface water to evaluate effectiveness of the remedy with respect to adjacent properties (RWE II).

Other particular requirements to be included in the Preliminary RD Reports are:

- Table of Contents for Technical Specifications;
- Surveying and mapping requirements to control and document implementation of the RWEs (e.g., basis for establishing the limits of soil excavation);
- Any value engineering proposals; and
- Preliminary assessment of methods to satisfy permitting requirements.

4.1.2 Engineering Drawings

Engineering drawings will be prepared to illustrate the preliminary design. The engineering drawings are expected to include:

• A title sheet.

• A site conditions map showing a variety of information including physical features,

topography, spot elevations, identified utilities, property lines, easements, wetlands

delineation, flood hazard areas, etc.

• A site plan illustrating the limits and depths of excavations; locations of the various

features of the groundwater extraction and treatment system; piping or utility runs;

decontamination, staging, borrow and stockpiling areas; site security measures; and

roadways. This drawing will also show the proposed final site contours.

· Additional drawings, if necessary to illustrate the design (e.g., cross-sections,

profiles, well construction details, etc.).

4.1.3 Technical Specifications

An outline of the specifications will be prepared. The specifications outline will follow the

standard format established by the Construction Specifications Institute (CSI)

4.1.4 Draft Remedial Construction Schedule

A draft remedial construction schedule will be prepared and included in the preliminary

design reports. The schedule will be in a timeline format and include milestones including

regulatory submittals and completion of major construction components. For RWE II, the

draft schedule will include operation of the remedial systems and post-remediation

monitoring activities.

4-4

4.2 FINAL REMEDIAL DESIGN REPORTS

The Final RD Reports will address all of the topics covered in the Preliminary RD Reports, but at a level commensurate with the more advanced stage of the design. Certain other topics, not a part of the preliminary reports, will be included in the Final RD Reports. These additional topics are identified below.

Each of the Final RD Reports will include an engineering report, design drawings, and technical specifications. Accompanying each final report will be supporting documentation, as follows:

- Construction Quality Assurance Project Plan (CQAPP) that will include necessary
 elements of the QAPP and SAMP for construction monitoring (e.g., soil sampling
 for deed restriction);
- Wetland Mitigation Plan;
- Quality Assurance Project Plan (QAPP) for long-term monitoring;
- Remedy Implementation Schedule; and
- Remedy Construction Cost Estimate.

Each of these elements (i.e., Final RD Reports and supporting documents) is further described below.

4.2.1 Engineering Report

The engineering reports for RWE I and II will reference the design basis stated for each RWE in its preliminary engineering report. If there are changes to the design basis based upon additional investigative activities (previously agreed with the agencies), they will be

described and the rationale presented. Topics presented in the preliminary reports will be revisited and brought current with final design status (e.g., the long-term monitoring plan will be completed). Topics that do not change will be referenced to the earlier reports.

Additional topics (not covered in the preliminary reports) that are to be addressed in the Final RD Reports include the following:

- Efforts made to secure access and obtain other approvals, as called for in the SOW;
- A description of the results of the access and approvals efforts;
- Legal descriptions of property or easements to be acquired (if any) in order to implement the remedial actions;
- Procedures for selection of the construction contractor; and
- A plan for implementation of construction;
- An analysis of methods to satisfy permitting requirements.

4.2.2 Engineering Drawings

The preliminary design drawings, which were part of the Preliminary RD Reports, will be changed to reflect the progress of the design to the stage that it is ready for construction. The preliminary design drawings will be supplemented with additional drawings as necessary to complete the design and go to the bidding phase. The supplemental drawings may, as appropriate, include such features as the following:

- Wiring, controls and alarm systems;
- Piping plan to illustrate final layout requirements;

• Typical construction details as necessary to illustrate the design;

• Equipment lists and schedules; and/or

• Wetlands delineation mapping.

4.2.3 Technical Specifications

Technical specifications will be prepared using the CSI format. The specifications will

address items such as equipment lists and performance criteria, contractor responsibilities

for design submittals and supporting specifications for control of work. In addition to the

standard construction specifications, a specification for Photographic Documentation of

Remedial Construction (or similar title) will be included.

4.2.4 Construction Quality Assurance Project Plan (CQAPP)

The Construction Quality Assurance Project Plan (CQAPP) will be prepared to describe

sampling, analysis, testing and monitoring to be performed during the remedial construction

phase of the work. The CQAPP will address quality assurance requirements and standards

related to the construction operations including:

• Inspection and certification

Measurement and daily logging

• Field performance and testing

Record drawings and logs

Criteria for testing the work

To the extent that sampling and analysis will be performed during construction (e.g., soil

sampling for deed restriction), the relevant portions of the QAPP and SAMP prepared as a

part of this RDWP will be incorporated in the CQAPP.

4-7

4.2.5 Wetlands Mitigation Plan

A plan will be developed that outlines actions to be implemented to avoid unnecessary disruption to wetland areas and to limit adverse impacts and/or compensate for wetlands adversely affected by the remedial activities at the site. A map will accompany the mitigation plan showing the delineated wetland boundaries, major plant communities, major soil types, and local hydrologic conditions.

4.2.6 Quality Assurance Project Plan for Long-Term Monitoring

As noted in Section 2.5, a long-term monitoring plan will be prepared as a part of the remedial design. The long-term monitoring plan will describe monitoring locations, frequency, analytical program, and media for the purpose of evaluating the performance of the remedy. Monitoring will include groundwater and may also include surface water and sediments. To perform this monitoring, a Quality Assurance Project Plan (QAPP) will be necessary in order to provide a planned and programmatic approach to quality assurance for the monitoring program. Therefore, a QAPP will be prepared. This QAPP will be prepared in accordance with the current guidance "EPA Requirements for Quality Assurance Project Plans," EPA QA/R-5, Interim Final, November 1999 and "EPA Guidance for Quality Assurance Project Plans," EPA QA/G-5, February 1998.

4.2.7 Proposed Remedial Construction Schedule

A proposed schedule for construction of the remedial activities associated with the implementation of RWE I and II will be prepared and submitted with the Final Design. This schedule will be presented in the format of a Gantt chart. Each major construction activity will be identified and its duration illustrated on the time-scale.

4.2.8 Remedial Construction Cost Estimate

Based on the remedial construction planned in the final RD for each of the RWEs, estimated costs to implement the construction will be prepared. This estimate will be

broken-down by major elements of the remedial construction. Allowances will be included for construction-related engineering services, QA/QC activities and similar costs associated with the construction. The cost estimate will be submitted concurrent with the Final RD Report.

1

5.0 REMEDIAL DESIGN SCHEDULE

Separate schedules for RWE I and RWE II of the remedial action design have been prepared and are included as Figures 5-1 and 5-2, respectively. In accordance with the SOW, the RWE I schedule provides for completion of the final design within 240 days of USEPA's written approval of the RDWP. The schedule for RWE II will be updated when the RDWP is updated for this remedial component.

As noted on Figure 5-1, the schedule may be affected by weather conditions prevalent at the time that construction may commence (i.e., following USEPA approval of the RAWP). The schedule as shown indicates a construction start date of February 18, 2002. Depending on actual weather conditions, it may not be possible to start at this time. Based on average prevailing weather conditions, the actual start date may need to move to spring 2002 to allow for appropriate working conditions to prevail. Depending on actual weather conditions, the expected completion date for the project could be as late as October 15, 2002.

The RWE I schedule shown in Figure 5-1 represents a standard schedule for completion of the work including a minimum of four weeks for USEPA review of each submittal, as requested by the Agency in comments dated October 24, 2000. In a meeting on November 7, 2000, it was agreed with USEPA that an expedited schedule will be pursued with the intent of completing implementation of RWE I during 2001. This schedule will be pursued informally on a parallel track as the work progresses.

FIGURE 5-1 CHEMSOL SUPERFUND SITE SOILS RD/RA SCHEDULE (1)

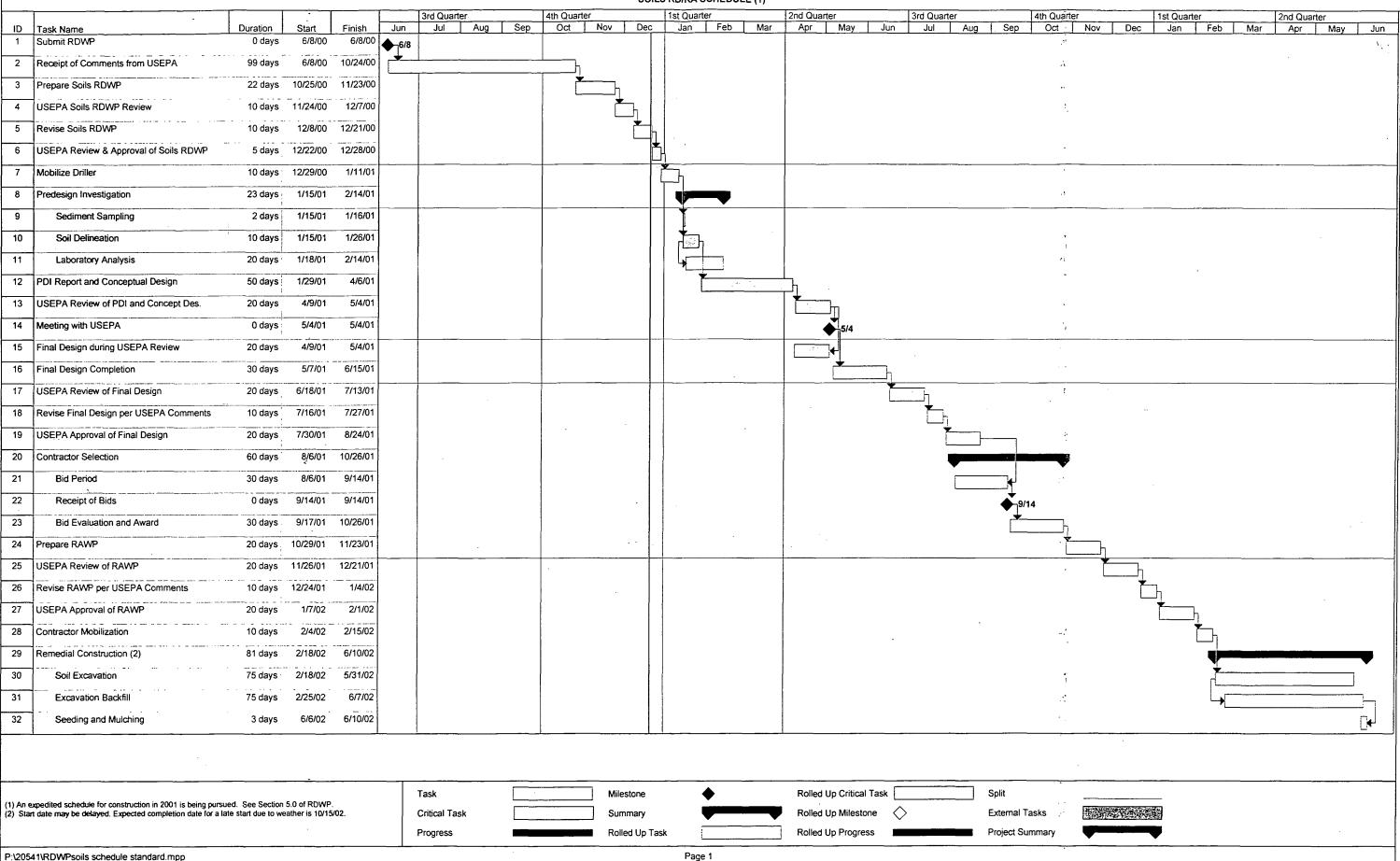
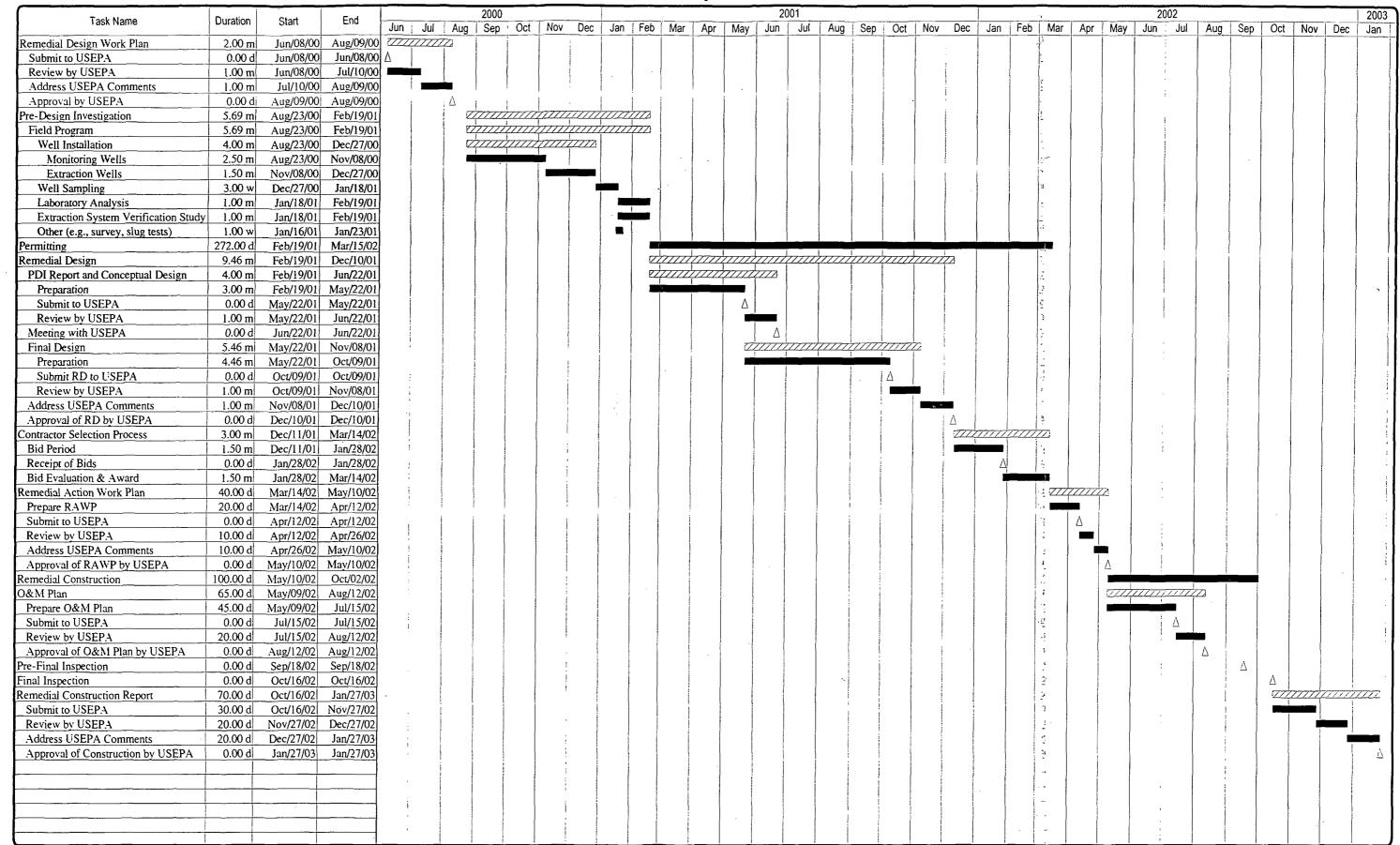


FIGURE 5-2 REMEDIAL ACTION DESIGN SCHEDULE— GROUNDWATER Chemsol Superfund Site



Note: Schedule will be revised to reflect actual approval dates by USEPA, as required.

Printed: May/31/00

ON 18026 DOMEN COUNCIL TI D

APPENDIX A

SAMPLING ANALYSIS AND MONITORING PLAN (SAMP)

APPENDIX B QUALITY ASSURANCE PROJECT PLAN (QAPP)

APPENDIX B

SUMMARY OF MDLS AND ANALYTICAL METHOD REFERENCE

objective is to define VOC concentrations to levels at or below the lesser of the New Jersey criteria referenced above. The MDLs obtained using the SW-846 Methodology, as presented in Attachment B, meet this objective for the site compounds identified in the FS as exceeding the lesser of either the Residential Direct Contact or Impact to Groundwater soil clean-up criteria. Therefore, this objective is met as well.

The data quality objectives with respect to groundwater are to define concentrations to levels below the groundwater ARARs which are the lesser of the Federal MCLs or New Jersey Groundwater Quality Standards (NJGWQS). The lower of the Federal MCL or NJGWQS for each compound, where available, are presented in Attachment B. Comparison of these data to the MDLs obtained using the SW-846 methodology indicates that this objective will be met for all of the TCL volatile, semi-volatile and inorganic site constituents. Therefore, this objective is met as well.

An MDL higher than an MCL occurs for the semi-volatile organic constituents of benzo(a)pyrene), 1,2-diphenylhydrazine, hexachlorobenzene, hexachlorobutadiene, and pentachlorophenol and the metals beryllium and thallium, all of which are much less mobile in the environment than the volatile organic constituents that have been identified as constituents of concern at the site. In addition, of the semi-volatile constituents, only benzo(a)pyrene was detected and infrequently and at very low levels. Beryllium was not detected above the MCL during the RI. Thallium detections were also at low levels and only with corresponding detections in the method blanks. As a result, none of the constituents with MDLs higher than an MCL are considered to be constituents of concern at the site, and thus the data quality objectives are met.

ARARs will also apply to the effluent from the treatment plant. To the extent that the discharge continues to the Middlesex County Municipal Utilities Authority treatment plant, the ARARs are the effluent criteria for the plant, which are currently being met. However, an alternative discharge to surface water is currently being pursued. A NJPDES application is in the process of being prepared with the expectation that the effluent limits will be the remediation standards defined at N.J.A.C. 7:14A-12, Appendix B, Effluent Standards for Site Remediation Projects. Based on these standards, compliance with effluent limit ARARs is

expected without the need for a waiver. Should the criteria change, the USEPA will be notified and adjustments made accordingly. The MDLs specified herein will meet the data quality objectives resulting from these effluent ARARs.

TABLE B-1
SUMMARY OF ANALYTICAL METHODS AND DETECTION LIMITS

Method Water: 5030/8260			Method Detect	ian I imita
Soil: 5035/8260			Method Detect	ion Limits
3011. 3033/8200	MCL or NJGWQS1	Low Water – 25mL	Water – 5mL	Soil
Volatiles	(μg/L)	(μg/L)	water = 3mL (μg/L)	μg/Kg)
Acetone	700 <u>(N)</u>	1.0	5	5
Benzene	1 <u>(N)</u>	0.1	1	1
Bromodichloromethane	1 <u>(N)</u>	0.1	1	1
Bromoform	4 <u>(N)</u>	0.1	2	1
Bromomethane	NA	0.4	2	2
2-Butanone	NA300 (N)	1.0	10	10
Carbon disulfide	NA	0.1	1	1
Carbon tetrachloride	2 <u>(N)</u>	0.2	1	1
Chlorobenzene	4 <u>(N)</u>	0.1	1	1
Chloroethane	NA	0.3	2	3
Chloroform	6 <u>(N)</u>	0.1	1	1
Chloromethane	NA	0.2	2	2
Dibromochloromethane	10 <u>(N)</u>	0.1.	. 1	1 1
1,2-Dichlorobenzene	600 <u>(N)</u>	0.1	1	1
1,3-Dichlorobenzene	600 <u>(N)</u>	0.1	1	1
1,4-Dichlorobenzene	75 <u>(M)</u>	0.1	1	1
Dichlorodifluoromethane	NA	0.3	2	' 2
1,1-Dichloroethane	70 <u>(N)</u>	0.1	1	1 1
1,2-Dichloroethane	2 (N)	0.1	1	1
1,1-Dichloroethene	2 <u>(N)</u>	0.1	1	1
cis-1,2-Dichloroethene	$+0\overline{7}(M)$	0.1	1	1
trans-1,2-Dichloroethene	100 <u>(M)</u>	0.1	1	1
1,2-Dichloropropane	1 <u>(N)</u>	0.2	1	1
cis-1,3-Dichloropropene	NA	0.1	1	' 1
trans-1,3-Dichloropropene	NA	0.1	1	1
Ethylbenzene	700 <u>(M)</u>	0.1	1	1
2-Hexanone	NA	0.2	3	2
4-Methyl-2-pentanone	400 <u>(N)</u>	0.2	2	2
Methylene chloride	2 (N)30	0.2	2	3
Styrene	100 _(M)	0.1	1	1
1,1,2,2-Tetrachloroethane	2 <u>(N)</u>	0.2	1	1
Tetrachloroethene	1 <u>(N)</u>	0.1	1	j 1
Toluene	1000 <u>(M)</u>	0.1	1	1
1,1,1-Trichloroethane	30 <u>(N)</u>	0.1	1	j 1
1,2,4-Trichlorobenzene	9 <u>(N)</u>	0.1	2	1
1,1,2-Trichloroethane	3 <u>(N)</u>	0.1	1	1
Trichloroethene	1 <u>(N)</u>	0.2	1	1
Trichlorofluoromethane	NA	0.1	2	2
Vinyl acetate	NA	0.2	1	1
Vinyl chloride	2 <u>(M)</u>	0.2	2	2
Xylene(total)	40 <u>(N)</u>	0.1	1	1

TABLE B-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND DETECTION LIMITS

Method Water: 3510/8270		Method Detec	tion Limits
Soil: 3540/8270			
	MCL or NJGWQS ¹	Water	Soil
Semi-Volatiles	(μg/L)	(μg/L)	(μg/Kg)
Acenaphthene	400 <u>(N)</u>	2	100
Acenaphthylene	NA	2	100
Anthracene	2000 <u>(N)</u>	2	100
Benzo(a)anthracene	NA	2	100
Benzo(a)pyrene	0.2 <u>(M)</u>	2	100
Benzo(b)fluoranthene	NA	2	100
Benzo(g,h,i)perylene	NA	2	100
Benzo(k)fluoranthene	NA	2	100
Benzyl alcohol	2000 <u>(N)</u>	2	100
bis(2-Chloroethoxy)methane	NA	1	100
bis(2-Chloroethyl)ether	10 <u>(N)</u>	2	100
bis(2-Chloroisopropyl)ether	300 (N)	1	100
bis(2-Ethylhexyl)phthalate	<u>6 (M)NA</u>	2	1300
4-Bromophenyl-phenylether	NA	2	100
Butylbenzylphthalate	100 <u>(N)</u>	2	100
Carbazole	NA	2	100
4-Chloroaniline	NA	1	100
2-Chloronaphthalene	NA	2	100
4-Chlorophenyl-phenylether	NA	2	100
Chrysene	NA	1	100
Dibenz(a,h)anthracene	NA	2	100
Dibenzofuran	NA	2	100
1,2-Dichlorobenzene	600 <u>(N)</u>	2	100
1,3-Dichlorobenzene	600 <u>(N)</u>	2	100
1,4-Dichlorobenzene	75 <u>(M)</u>	2	100
3,3'-Dichlorobenzidine	60 <u>(N)</u>	. 2	500
Diethylphthalate	5000 <u>(N)</u>	1	100
Dimethylphthalate	NA	2	100
Di-n-butylphthalate	NA	2	100
2,4-Dinitrotoluene	10 <u>(N)</u>	2	100
2,6-Dinitrotoluene	<u>10 (N)NA</u>	1	100
Di-n-octylphthalate	100 <u>(N)</u>	2	100
1,2-Diphenylhydrazine	0.04 <u>(N)</u>	1	100
Fluoranthene	300 <u>(N)</u>	2	100
Fluorene	300 <u>(N)</u>	1	100
Hexachlorobenzene	1 <u>(M)</u>	2	100
Hexachlorobutadiene	1 <u>(N)</u>	2	100

^{* =} These MDL's were determined in the laboratory using laboratory reagent water as the matrix.

TABLE B-1 (Continued)
SUMMARY OF ANALYTICAL METHODS AND DETECTION LIMITS

Method Water: 3510/8270		Method Det	ection Limits
Soil: 3540/8270			
	MCL or NJGWQS1	Water	Soil
Semi-Volatiles (continued)	(μg/L)	(μg/L)	(μg/Kg)
Hexachlorocyclopentadiene	50 (M)	1	100
Hexachloroethane	10 (N)	1	100
Indeno(1,2,3-cd)pyrene	NA	2	100
Isophorone	100 <u>(N)</u>	2	100
2-Methylnaphthalene	NA	2	100
Naphthalene	NA	2	100
2-Nitroaniline	NA	2	100
3-Nitroaniline	NA	. 2	100
4-Nitroaniline	NA	2	100
Nitrobenzene	10 <u>(N)</u>	1	100
N-Nitroso-di-methylamine	20 <u>(N)</u>	1	100
N-Nitroso-di-n-propylamine	20 <u>(N)</u>	2	100
N-Nitrosodiphenylamine	20 <u>(N)</u>	. 2	100
Phenanthrene	NA	2	100
Pyrene	200 <u>(N)</u>	2	100
1,2,4-Trichlorobenzene	9 <u>(N)</u>	2	100
Benzoic acid	NA	2	100
1-Chloro-3-methylphenol	NA	2	100
2-Chlorophenol	40 <u>(N)</u>	2	100
2,4-Dichlorophenol	20 <u>(N)</u>	2	100
2,4-Dimethylphenol	NA <u>100 (N)</u>	2	100
4,6-Dinitro-2-methylphenol	NA	4	100
2,4-Dinitrophenol	40 <u>(N)</u>	7	700
2-Methylphenol	NA	2	100
1-Methylphenol	NA	4	100
2-Nitrophenol	NA	1	100
I-Nitrophenol	NA	3	100
Pentachlorophenol	1 <u>(M)</u>	5	500
Phenol	4000	1	100
2,4,5-Trichlorophenol	700	2	100
2,4,6-Trichlorophenol	NA	2	100

TABLE B-1 (Continued)

SUMMARY OF ANALYTICAL METHODS AND DETECTION LIMITS

Method		Detection	Timin #
Water: 3510/8081		Detection	Limits *
Soil: 3540/8081	MOL 1	11.7-A	0.11
Th	MCL ¹	Water	Soil
Pesticides	(μg/L)	(μg/L)	(μg/Kg)
Alpha-BHC	0.02 <u>(N)</u>	0.005	0.50
Beta-BHC	0.2 <u>(N)</u>	0.005	0.50
Gamma-BHC	0.2 <u>(N)</u>	0.005	0.50
Delta-BHC	NA	0.005	0.50
Aldrin	0.04 <u>(N)</u>	0.005	0.50
Chlordane	0.5 <u>(N)</u>	0.025	2.5
4,4'-DDD	0.1 <u>(N)</u>	0.010	1.0
4,4'-DDE	0.1 <u>(N)</u>	0.010	1.0
4,4'-DDT	0.1 <u>(N)</u>	0.010	1.0
Dieldrin	0.03 <u>(N)</u>	0.010	1.0
Endosulfan I	0.4 <u>(N)</u>	0.005	0.50
Endosulfan II	0.4 <u>(N)</u>	0.010	1.0
Endosulfan Sulfate	0.4 <u>(N)</u>	0.010	1.0
Endrin	2 <u>(N)</u>	0.010	1.0
Endrin Aldehyde	NA	0.010	1.0
Endrin Ketone	NA	0.010	1.0
Heptachlor	0.4 <u>(M)</u>	0.005	0.50
Heptachlor Epoxide	0.2 <u>(M)</u>	0.005	0.50
Methoxychlor	40 <u>(M)</u>	0.05	5.0
Toxaphene	3 <u>(M)</u>	1.0	100

^{* =} These detection limits are defined as ½ the level of the lowest standard in the calibration curve.

Water: 3510/8082 Detection Limits * Soil: 3540/8082

5011. 55 10/0002			
	MCL^1	Water	Soil
PCBs	(µg/L)	$(\mu g/L)$	(μg/Kg)
PCB-1016	NA <u>0.5 (M)</u>	0.25	25
PCB-1221	NA <u>0.5 (M)</u>	0.25	25
PCB-1232	NA 0.5 (M)	0.25	25
PCB-1242	NA <u>0.5 (M)</u>	0.25	25
PCB-1248	NA <u>0.5 (M)</u>	0.25	25
PCB-1254	NA 0.5 (M)	0.25	25
PCB-1260	Na <u>0.5 (M)</u>	0.25	25

^{• *=} These detection limits are defined as $\frac{1}{2}$ the level of the lowest standard in the calibration curve.

[•] MCL shown is for total PCBs not individual aroclors.

TABLE B-1 (Cont'd)
SUMMARY OF ANALYTICAL METHODS AND DETECTION LIMITS

	MCL^1	Analytical	Method ^b	Method Dete	ection Limits ^a
Inorganics	(μg/L)	(μg/L) Water		Water	Soil
				(μg/L)	(mg/kg
Aluminum	200 <u>(M)</u>	6010	6010	50	2.5
Antimony	206 (M)	6010	6010	10	0.50
Arsenic	8 (N)	6010	6010	5.0	0.25
Barium	2000(M)	6010	6010	5.0	0.25
Beryllium	4 (M) 20	6010	6010	5.0	0.25
Cadmium	4 <u>(N)</u>	6010	6010	1.0	0.050
Calcium	NA	6010	6010	1,000	50
Chromium(total)	100 <u>(M)</u>	6010	6010	5.0	0.25
Cobalt	NA	6010	6010	5.0	0.25
Copper	1000 <u>(N)</u>	6010	6010	5.0	0.25
Iron	300 <u>(M)</u>	6010	6010	50	2.5
Lead	10 <u>(N)</u>	6010	6010	5.0	0.25
Magnesium	NA	6010	6010	1,000	50
Manganese	50 <u>(M)</u>	6010	6010	5.0	0.25
Mercury	2 <u>(M)</u>	7470/245.1 ^c	245.5 ^d	0.20	0.050
Molybdenum	NA	6010 ^e	6010	5.0	0.25
Nickel	100 <u>(N</u>)	6010	6010	5.0	0.25
Potassium	NA	6010	6010	1,000	50
Selenium	50 (M)+0	6010	6010	5.0	0.25
Silver	<u>NA50</u>	6010	6010	1.0	0.050
Sodium	50000 <u>(N)</u>	6010	6010	1,000	50
Thallium	2 (M)+0	6010	6010	5.0	0.25
Vanadium	NA	6010	6010	5.0	0.25
Zinc	5000 <u>(N)</u>	6010	6010	10	0.50
Cyanide	200 <u>(M)</u>	9010	9010	5.0	0.50
Phenol	4000(N)	9066	9066	10	5.0

^aDetermined at Eckenfelder Laborataory, LLC (Calcium, Magnesium, Sodium and Potassium excluded) with lab water as the matrix; soil MDLs are calculated from the water MDLs.

busepa sw-846.

^cUSEPA MCAWW (USEPA 1983).

dUSEPA Contract Laboratory Program, SOW for Inorganics, 3/90 (ILM01.0).

^eThe analysis of Molybdenum is not a routine procedure but a project-specific requirement. A customized LCSW mix will contain this target analyte.

¹Lower of Federal MCL or NJGWQS (N) denotes NJGWQS and (M) denotes Federal MCL.

APPENDIX C HEALTH AND SAFETY CONTINGENCY PLAN (HASCP)

APPENDIX D

NOVEMBER/DECEMBER 1998 WATER QUALITY DATA

SUMMARY OF EXISTING WELL INSTALLATIONS CHEMSOL INC. PISCATAWAY, NEW JERSEY

	Reference		Ground	Coordinat	es (c.)	Scre	ened	Scre	ened	Screen
Well ^(a)	Elevation	Zone	Elevation	Northing	Easting	Into	erval	Interval		Length
	(ft., msl)		(ft., msl)			Elevation	(ft, msl)	Feet bel	ow G.S.	(ft)
~ .	70.00	244				50.3		# 0		1040
C-1	79.83	3/4	77.30	629,997	2,062,281	70.3	-55.7	7.0	133.0	126.0
C-2	86.24	5	85.20	629,865	2,061,790	-177.8	-202.8	263.0	288.0	25.0
C-3	80.52	4	78.70	629,642	2,062,565	-16.3	-41.3	95.0	120.0	25.0
C-4	80.96	4	79.10	629,636	2,062,307	-24.9	-49.6	104.0	128.7	24.7
C-5	80.10	4	78.30	629,815	2,062,297	-20.4	-46.7	98.7	125.0	26.3
C-6	76.12	3	73.50	630,574	2,062,609	-3.5	-27.5	77.0	101.0	24.0
C-7	80.20	3	78.20	630,534	2,061,803	-66.8	-90.8	145.0	169.0	24.0
C-8	81.40	3	79.40	630,140	2,061,554	-36.6	-58.6	116.0	138.0	22.0
C-9	85.33	3	83.60	629,925	2,061,589	-6.9	-31.4	90.5	115.0	24.5
C-10	80.71	3	78.30	630,292	2,061,975	-23.7	-46.7	102.0	125.0	23.0
DMW-1	85.40	5	82.90	629,867	2,062,117	-142.1	-167.1	225.0	250.0	25.0
DMW-2	85.07	6	83.60	629,670	2,062,085	-216.4	-241.4	300.0	325.0	25.0
DMW-3	80.49	6	78.70	629,656	2,062,566	-146.3	-171.3	225.0	250.0	25.0
DMW-4	80.44	6	78.60	629,660	2,062,532	-221.4	-246.4	300.0	325.0	25.0
DMW-5	78.89	5	77.10	630,166	2,062,022	-147.9	-172.9	225.0	250.0	25.0
DMW-6	79.23	5	77.70	630,138	2,062,030	-222.3	-262.3	300.0	340.0	40.0
DMW-7	76.62	5	75.70	630,132	2,062,439	-149.3	-174.3	225.0	250.0	25.0
DMW-8	77.77	6	76.00	630,121	2,062,428	-224.0	-249.0	300.0	325.0	25.0
DMW-9	76.35	4	73.80	630,578	2,062,618	-73.2	-97.2	147.0	171.0	24.0
DMW-10	79.58	4	78.00	630,540	2,061,816	-149.0	-173.0	227.0	251.0	24.0
DMW-11	85.04	5	84.00	629,918	2,061,792	-142.0	-166.0	226.0	250.0	24.0
MW-101	79.80	6	77.50	629,995	2,062,253	-247.5	-262.5	325.0	340.0	15.0
MW-102	78.69	6	77.50	629,863	2,062,471	-247.5	-262.5	325.0	340.0	15.0
MW-103	81.09	5	79.80	630,144	2,061,572	-245.2	-270.2	325.0	350.0	25.0
MW-104	88.58	6	88.90	628,957	2,062,510	-157.1	-176.1	246.0	265.0	19.0
OW-1	78.37	1	76.40	630,036	2,062,275	73.4	68.4	3.0	8.0	5.0
OW-2	81.64	1	79.80	629,898	2,062,206	76.8	71.8	3.0	8.0	5.0
OW-4	79.96	1	77.30	629,921	2,062,332	72.3	67.3	5.0	10.0	5.0
OW-10	79.06	1	78.40	629,660	2,062,549	73.4	63.4	5.0	15.0	10.0

SUMMARY OF EXISTING WELL INSTALLATIONS CHEMSOL INC. PISCATAWAY, NEW JERSEY

	Reference		Ground	Coordinat	es (c.)	Scre	ened	Scr	eened	Screen
Well ^(a)	Elevation	Zone	Elevation	Northing	Easting	Inte	rval	Inte	erval	Length
	(ft., msl)		(ft., msl)			Elevation (ft, msl)		Feet below G.S.		(ft)
OW-11	75.08	1	74.30	630,592	2,062,609	70.3	60.3	4.0	14.0	10.0
OW-12	84.65	1	82.50	629,888	2,061,897	77.5	70.0	5.0	12.5	7.5
OW-13	82.96	1	81.00	629,988	2,061,673	77.5	69.5	3.5	11.5	8.0
OW-14	92.14	1	90.20	629,643	2,061,657	86.2	78.7	4.0	11.5	7.5
OW-15	75.08	1	73.00	630,390	2,062,545	00.2	, 0.,		11.5	7.5
PZ 1	76.62	1	74.90	630,157	2,062,437			•		
PZ 1D	77.05	1		630,172	2,062,437					
PZ 2	76.45	1	74.50	630,051	2,062,474					
PZ 2D	75.94	1		630,066	2,062,475					
PZ 3	78.65	1	74.30	629,919	2,062,438					
PZ 4	78.03	1	76.00	630,280	2,062,084					
PZ 4D	78.25	1		630,289	2,062,090				,	
PZ 5	76.68	1	74.90	630,250	2,062,208					
PZ 5D	76.86	1		630,251	2,062,193					
PZ 6	76.15	1	74.20	630,227	2,062,373					
PZ 6D	76.14	1		630,227	2,062,389					
PZ 7	75.71	1	73.80	630,229	2,062,459					
PZ 8	77.57	1	75.70	629,971	2,062,477					
PZ 8D	77.51	1	·	629,986	2,062,477					
PZ 9D	75.98	1		630,295	2,062,410			÷		
PZ 10D	79.08	1		630,086	2,062,273					
SG@PZ 4	71.67	1		630,267	2,062,067					
SG@PZ 8	73.95	1		629,983	2,062,495					
TW-1	90.15	2	89.10	629,638	2,061,637	76.0	24.0	13.1	65.1	52.0
TW-2	85.81	2	84.30	629,900	2,061,591	72.3	24.3	12.0	60.0	48.0
TW-3	81.59	2	79.70	630,160	2,061,538	65.7	29.7	14.0	50.0	36.0
TW-4	78.31	2	76.60	630,218	2,062,010	58.1	27.6	18.5	49.0	30.5
TW-5	76.24	2	74.30	630,175	2,062,475	54.3	29.3	20.0	45.0	25.0
TW-5A	75.98	2	74.40	630,166	2,062,470	54.4	29.4	20.0	45.0	25.0

SUMMARY OF EXISTING WELL INSTALLATIONS CHEMSOL INC. PISCATAWAY, NEW JERSEY

	Reference		Ground	Coordinat	es (c.)	Scre	ened	Scre	ened	Screen
Well ^(a)	Elevation (ft., msl)	Zone ^a	Elevation (ft., msl)	Northing	Easting	Inte Elevation	rval (ft, msl)		erval ow G.S.	Length (ft)
TW-6	78.88	4	76.70	629,894	2,062,490	57.7	31.7	19.0	45.0	26.0
TW-7	80.16	4	78.00	629,655	2,062,399	61.5	28.0	16.5	50.0	33.5
TW-8	85.11	4	83.40	629,647	2,062,102	67.4	23.4	16.0	60.0	44.0
TW-9	80.29	4	78.70	629,662	2,062,557	59.2	29.7	19.5	49.0	29.5
TW-10	79.96	2	78.50	630,549	2,061,809	59.0	18.5	19.5	60.0	40.5
TW-11	75.76	2	75.00	630,594	2,062,620	56.5	27.0	18.5	48.0	29.5
TW-12	75.73	2	73.60	630,594	2,063,195	54.1	24.6	19.5	49.0	29.5
TW-13	78.17	4	76.30	630,092	2,063,250	57.8	27.3	18.5	49.0	30.5
TW-14	89.23	4	88.80	629,332	2,061,661	69.3	29.8	19.5	59.0	39.5
TW-15	82.90	4	82.40	629,380	2,062,367	67.4	22.4	15.0	60.0	45.0
TW-15R ^(c)	81.40	4	82.40	629,380	2,062,367	67.4	22.4	15.0	60.0	45.0

NOTES:

- a. Wells are screened in the following zones:
 - 1. Overburden Water-Bearing zone
 - 2. Upper Bedrock Aquitard
 - 3. Upper Permeable Aquifer
 - 4. Upper of portion of Principal Aquifer
 - 5. Lower of portion of Principal Aquifer
 - 6. Deep Bedrock Zone
- c. TW-15 was modified as a flush-mounted well in December 1998 and re-designated as TW-15R.

TABLE 2

CHEMSOL GROUNDWATER MONITORING DATA
TOTAL VOCs (ppb)

Well Groups	Hydrostratigraphic Zone (b.)	RI Round #1 MarApr. 1994 (CDM)	RI Round #2 Oct. 1994 (CDM)	Pre-PDI Nov Dec. 1998 (Eckenfelder/BC)
TW-10	2	ND	3.0	ND
C-7	3	529.0	388.9	270.6
DMW-10	4	443.0	297.0	85.0
OW-11	1	ND	ND	ND
TW-11	2	1.0	1.6	0.3
C-6	3	196.0	16.8	5.0
DMW-9	4	5,469	16,158	3495
OW-15	1			12.0
TW-3	2	3.0	ND	7.8
C-8	3	5.5	21.0	22.3
MW-103	5	6.9	2.0	42.0
ΓW-4	2	62,440	78,290	94,470
C-10	3	12,397	11,205	7,176
DMW-5	5	50.0	104.7	448.0
DMW-6	5	241.0	216.0	569.9
TW-5	2	86,980	106,620	72,820
TW-5A	2	40,690	23,073	23,630
DMW-7	5	4,238	2,949	867.0
DMW-8	6	2,772	47,360	1503
OW-13	1	ND	ND	NS
TW-2	2	7.0	11.0	27.9
C-9	3 .	16.0	12.8	5.8
OW-12	1 .	478.0	117.0	251.0
DMW-11	5	2,708	2,994	2,514.0
C-2	5	7,716	3,252	1,675
OW-1	1	16,189	DRY	NS
OW-2	1	429.0	541.0	31.0
OW-4	1	3,046	6,308	NS
C-5	4	791.0	19,244	2,455
MW-101	6	21.0	9.9	98.0
TW-6	4	1,260.0	666.0	312.0
MW-102	6	190.0	242.0	362.0

TABLE 2

CHEMSOL GROUNDWATER MONITORING DATA
TOTAL VOCs (ppb)

Well Groups	Hydrostratigraphic Zone (b.)	RI Round #1 MarApr. 1994 (CDM)	RI Round #2 Oct. 1994 (CDM)	Pre-PDI Nov Dec. 1998 (Eckenfelder/BC)
OW-14	1	NA	NA	NS
TW-1	2	30.0	15.0	25.3
TW-8	4	87,865	63,960	18,518
DMW-1	5	2,316	2,124	1,188.0
DMW-2	6	16.0	134.0	59.3
TW-7	4	13,520	7,466	13399
C-4	4	4,015	3,240	1982
OW-10	1	2.0	ND	1.0
TW-9	4 .	74.0	40.8	16.0
C-3	4	110.0	164.9	67.0
DMW-3	6	1,203.0	1,140.0	383.4
DMW-4	6	117.0	192.0	110.8
TW-14	4	ND	0.7	4.0
TW-15	4	14.0	9.0	25.8
TW-12	2	ND	2.0	ND
TW-13	4	ND	ND	1.0

a. NS= not sampled

- 1. Overburden Water-Bearing Zone
- 2. Upper Bedrock Aquitard
- 3. Upper Permeable Aquifer
- 4. Upper of portion of Principal Aquifer
- 5. Lower of portion of Principal Aquifer
- 6. Deep Bedrock Zone

b. Wells are screened in the following zones: